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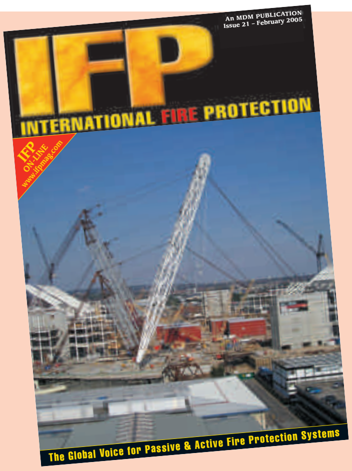

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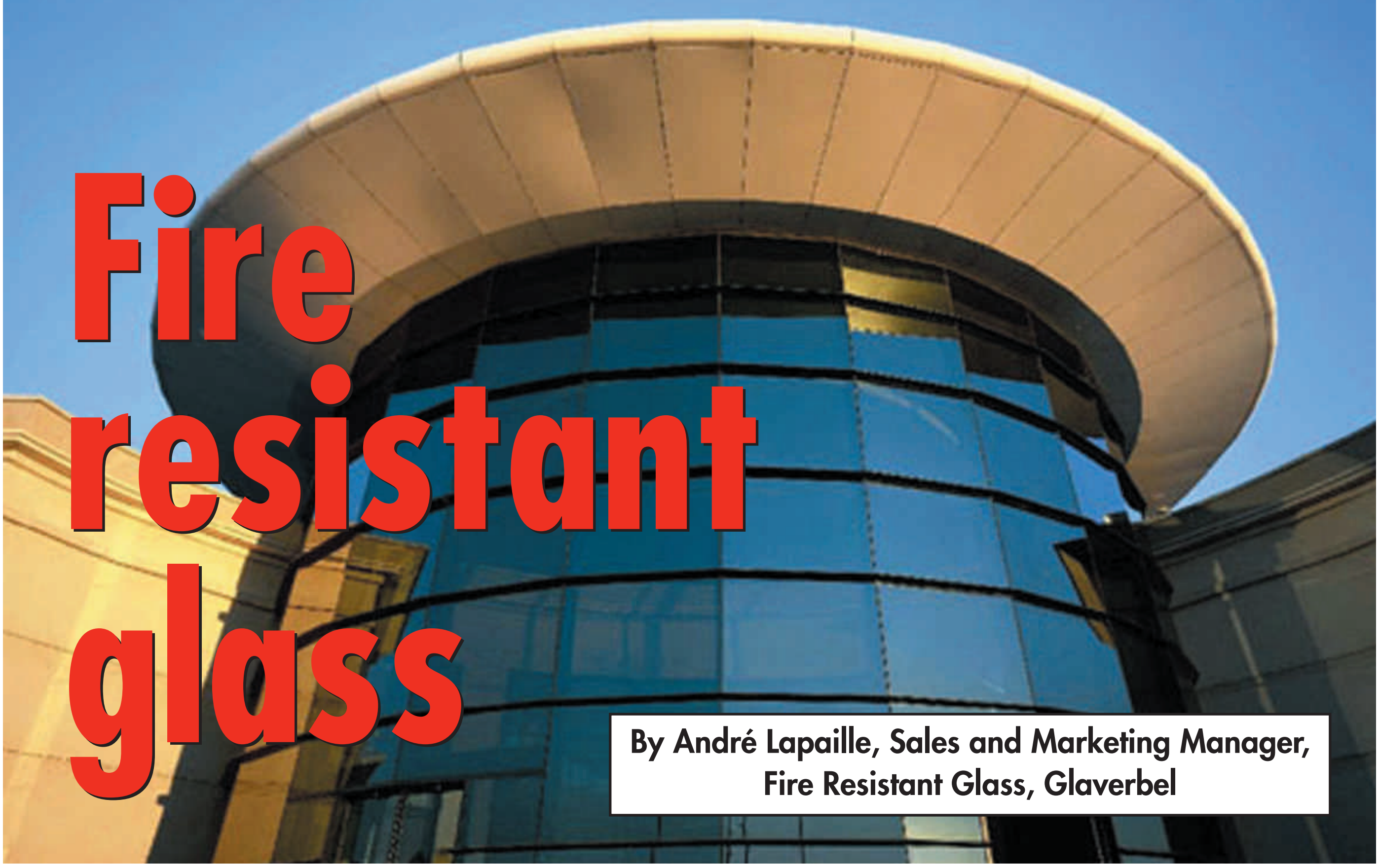
AN APOLOGY: IN THE NOVEMBER ISSUE 20 OF IFP MAGAZINE. A MISTAKE WAS MADE WITHIN OUR ARTICLE ON THE SELECTION OF CABLE TYPES ON **PAGES 22-24**. THE AUTHOR SHOULD HAVE BEEN CREDITED AS **MARCELLO CELENTANO OF THE CAVICEL SpA COMPANY**. WE FULLY APOLOGISE FOR ANY UPSET OUR MISTAKE INCURRED THE AUTHOR AND HIS COMPANY. WE HOPE THIS CLEARS UP ANY CONFUSION OVER THIS ARTICLE.


www.bbc.be

Fire resistant glass

By André Lapaille, Sales and Marketing Manager, Fire Resistant Glass, Glaverbel



Pic courtesy of Glaverbel

CLEAR, SIMPLE, SAFE AND CONSISTENT SOLUTIONS

NOWADAYS NO-ONE can imagine modern non-residential buildings without fire resistant glass as it offers a combined solution to the fire protection required by regulations and fire engineering as well as the ever increasing demand for light and transparency, whether in façades or in internal doors and partitions.

The days of concrete façades with small windows, dark rooms, narrow and gloomy corridors and stairs are definitely over. People in the 21st century want to live and work in an open and natural environment which only glass with its unique properties can provide.

It is readily accepted as fact that we live in a world of communication, but it is less common to point out that communication is not limited to high-tech electronic equipment but starts with visual contact between people and the active world around us. Furthermore, everyone agrees that natural light is essential for keeping in touch with the daily life-cycle, and keeping your internal body clock running on time, in order to maximise well-being in your life and workspace.

This belief is so widely held that the fire resistant glass and frame manufacturers face a paradoxical situation: their challenge is no longer to promote the use of their products to building planners but to ensure that the wishes of their customers do not exceed the technical capabilities of their products, in terms for example of maximum tested sizes.

Pic courtesy of Glaverbel

Fire resistant glass producers have a shared responsibility to explain which glass can be used where and how, in close collaboration with the frame manufacturers based on our expertise and know-how. However, it is essential to do so in a simple and efficient way, to avoid misunderstanding and confusion that could result in installing the wrong type glass in the wrong place. Presenting the list of our numerous fire and safety tests, according to national or European standards, is not enough as they form a kind of jungle where a planner cannot easily navigate his way.

CLEAR SOLUTIONS: BASIC CONCEPTS AND THEIR CONSEQUENCES

A fire resistant glass that provides only fire **integrity** is not comparable to a glass that provides **integrity and limited radiation** nor to a glass that provides **integrity and full heat insulation.**

If **integrity only** glasses are acceptable – from a real fire protection viewpoint – in certain applications, the amount of radiated heat released

Fire resistant glass

makes them highly inadequate in internal large glazed screens to protect people and avoid material ignition.

Furthermore, it is important to explain that not all integrity glasses have the same properties: where wired glass will always have the same behaviour in any fire conditions (glass will crack but the pieces will be hold together by the wire mesh), toughened fire rated glasses may break and collapse rapidly if the fire conditions differs from the standard testing conditions.

Integrity glasses with limited radiation represent an interesting alternative to integrity only glasses as they limit the radiated heat to a more acceptable level for people and materials.

Here again, different technologies result in different behaviour: toughened glasses with a heat reflective coating will limit the radiated heat to some 10 to 15 KW per sqm, where laminated glasses using special layers such as Glaverbel Pyrobelite, will keep this value well below 10 KW.

Alternatively, fire resistant glass providing **integrity and full heat insulation** such as Glaverbel Pyrobel® will protect people and materials in any circumstances, as its performance in a fire situation is based on the transformation of each of its special layers into a rigid and opaque foam that holds the glass pieces together and blocks out all dangerous radiant heat.

Several insulated fire rated glasses are available on the market, based on different types of interlayer and processing, and unless they differ in secondary properties (such as their tested dimensions in various framing systems, their safety or acoustic performances, their resistance to UV rays, their availability within a short delivery time from local processors, their ability to be combined with patterned, burglar or bullet proof, low-e or solar control glasses in a single or in a double unit) they all present a level of highly effective protection for people and property.

SIMPLE SOLUTIONS

Planners are often confused by the fire resistant glass range of products offered by some manufacturers, for example, when several products cover the same fire rating or when the product thickness varies with the installed dimensions.

Glaverbel's range of fire resistant glass, for example, is based on one single product with a unique thickness per rating, covering all tested dimensions and framing systems:

- One Pyrobelite® structure for 30 minutes integrity with limited radiations
- Four Pyrobel® structures for respectively 30, 60, 90, 120 minutes insulation.

The product names give the rating and the thickness (e.g. Pyrobel EI30/16). Such a straightforward policy greatly simplifies project planning for our customers, and removes the risk of specifying the wrong product or thickness and increases the efficiency of the whole supply chain.

SAFE SOLUTIONS

Safety does not refer only to mechanical impact, as described in the BS 6206 or in the EN 12600 norms; it deals with the real safety provided.

It is important for planners to know that toughened glass, although classified as a safety glass, will break and fall into pieces if subjected to a hard point impact whereas a laminated fire resistant glass will remain safely in one piece after a soft or a hard impact.

Another aspect to be highlighted is that, in the event of a fire, the toxicity of the gases emitted by the special layers used in laminated fire resistant glasses is not currently taken into consideration by the present classification standards. One reason for this being that the definition and measuring of

Pic courtesy of Glaverbel

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toxicity is not an easy task. For certain products however, these gases appears to be – if not perhaps toxic – at the very least irritating.

A simple test on a small sample with a blowtorch will give an idea of the density and breathability of the gases emitted when the interlayers are burning.

Pic courtesy of Glaverbel

CONSISTENT SOLUTIONS

Once the planner has determined which fire protection he requires and which product best fulfils his requirements, he must make sure that the fire resistant element to be installed, i.e. the frame, the glass and the glazing materials, provides as a whole the level of required protection.

Although all fire resistant frame and glass manufacturers are able to provide numerous test reports in various configurations, it is impossible to test all potential applications, from an economical point of view and from a practical point of view as standard furnaces typically have a 3 × 3 m opening, which prevent the full size testing of real-life elements such as a double door and large side panels or elements higher than 3 m.

Therefore, certification bodies may, on request, issue assessments based on one or several test reports and on their knowledge to validate the suitability of a given project. These bodies are well aware of each product's behaviour and will modulate their judgment accordingly.

The harmonized European standards and the CE marking process will increase the consistency of the fire resistant glass applications in the future:

- Firstly, external factory production controls will become compulsory to ensure that all products have the same and sufficient characteristics as the tested samples.
- Secondly, a certification approved body will gather all available historical data per product and initiate the required new initial type tests according to EN norms.
- Thirdly, each new fire test carried out according to the EN standards in one approved European laboratory will be valid in all European countries, which will enable the manufacturer to increase the number of tested configurations for the same global testing budget.
- Finally, the field of extended applications, which varies today country by country via the national assessments, will be formalized and unified on European level as well.

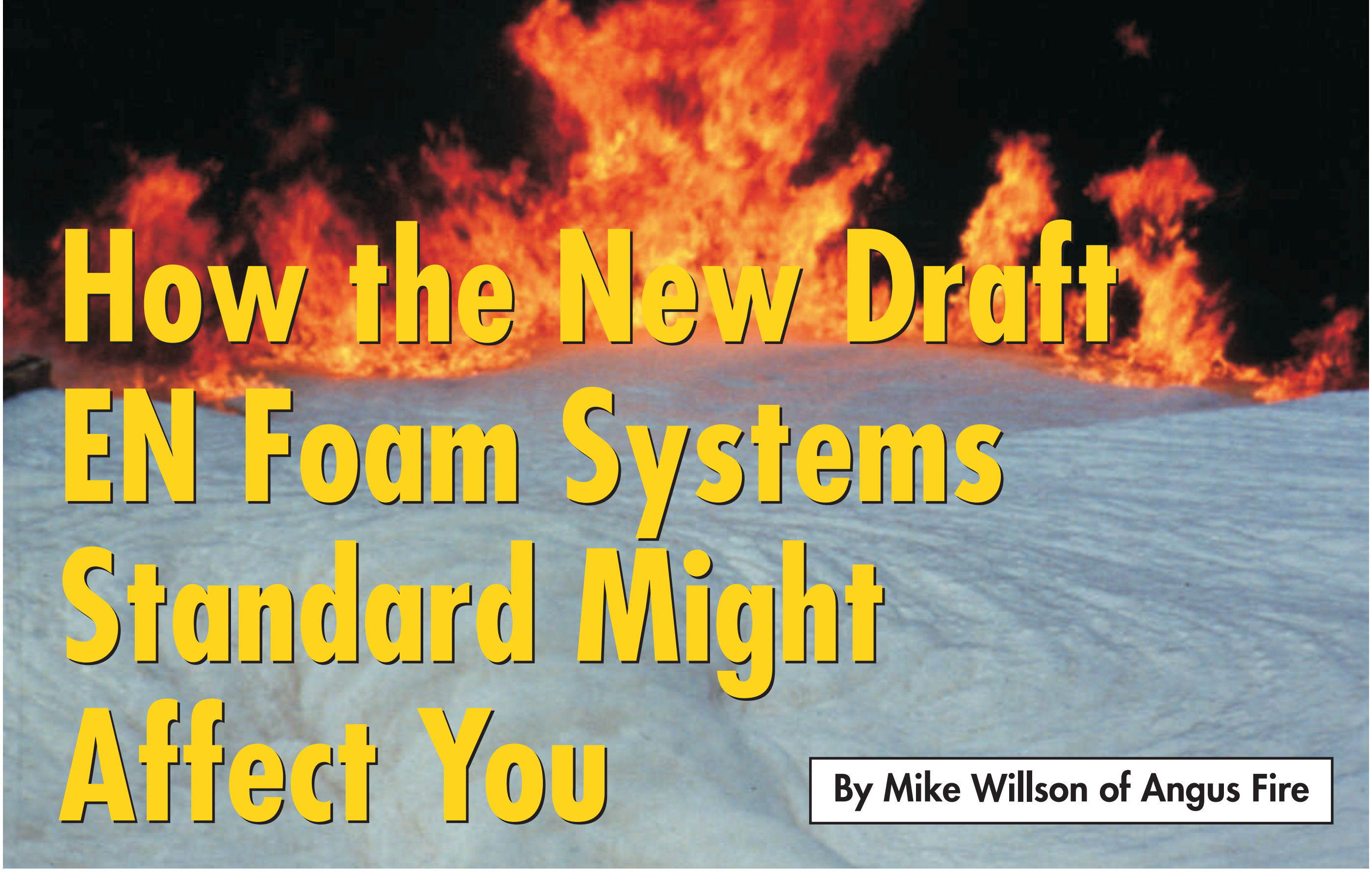
Each manufacturer will be able to clearly communicate the capabilities of their products in each framing system to planners, and the end-users will be guaranteed effective protection.

Clear, simple, safe and consistent solutions!

André Lapaille joined the FRG Business Unit of Glaverbel in 1990 and has since witnessed the evolution of the fire resistant glass market in Europe and Overseas.

How the New Draft EN Foam Systems Standard Might Affect You

By Mike Willson of Angus Fire



Pic courtesy of Angus Fire

A NUMBER OF EN standards are being developed to help unify a historical situation where a group of disparate and sometimes contradictory national standards across Europe can be effectively merged into a single European Norm (EN). These new EN standards can then be accepted and widely adopted by you the foam users, throughout the expanding European Union, as a basis for even safer and more reliable fire system designs into the future.

UL162 FOAM STANDARD STILL HAS UNIQUE BENEFITS

The various parts of the EN1568:2000 Foam Concentrates Standard are beginning to be used and recognised as a credible standard, although it still does not have 4 vitally important and currently unique foam user benefits achieved by the Underwriters Laboratories UL162 foam standard (7th edition) which covers a broad spectrum of foam applications. It is therefore important to specify EN1568 and/or UL162 foam standards when buying foam in future. UL 162 is the most widely used and respected foam concentrate standard in the fire industry – and for 4 good reasons. UL 162 is specified and recognised as the benchmark of quality throughout the Oil and Petrochemical industry worldwide.

This is largely because:

1. Independent UL inspectors act as "policemen" for the foam user, to ensure that any manufacturer does not change the performance specification of the product over time. This is achieved by repeated factory inspections and random product testing to verify compliance with the originally tested sample. No other foam standard does this.
2. The foam concentrate is not tested in isolation. To achieve a UL listing any foam concentrate has to be shown to work with proprietary pieces of induction and delivery equipment (themselves subjected to stringent testing and UL listing) to make up an effective operating "system", whether for portable or fixed system use. No other foam standard does this.
3. The container must be tested to verify that it will not leak or split if accidentally dropped during transit, protecting your investment and keeping you out of trouble with local environmental inspectors. No other foam standard does this.
4. Poor quality products actually FAIL, so it is an independent benchmark level of performance reliability and manufacturing quality, necessary and appreciated by many major foam users.

CAUTION REQUIRED WHEN MOST PRODUCTS PASS

An element of caution is required with the EN1568 standard because it is quite difficult for any product to actually fail. There is also no single specialist body that has to verify compliance to the standard requirements at a particular level. There are a number of test houses authorised to carry out, witness and certify these tests, but they do not necessarily interpret these standards in an identical way. There are moves to try and ensure this anomaly is corrected but this will still take some time. It is therefore crucial for foam users to

Pic courtesy of Angus Fire

DEVELOPED BY WORLD SPECIALISTS

This new prEN 13565-2 has been developed by a dedicated international committee of foam system users and specifiers, fire protection and risk management consultants as well as knowledgeable applications specialists in each major foam area covered by the draft standard. They have been preparing these detailed recommendations for several years to reach the point where this draft standard is now being translated into French and German prior to release for public comment, expected early in 2005.

While endeavouring not to contradict existing well respected foam standards like NFPA11, NFPA 11A and British Standard BS5306 Sections 6.1 and 6.2, this new standard will be extending the boundaries into areas beyond their current recommendations.

HIGHER APPLICATION RATES REQUIRED FOR POORER PERFORMING FOAMS

This is a broad ranging standard which looks at the suitability of Low, Medium and High expansion foams for specific hazards. It also takes a new approach to practical considerations. It takes into effect specific minimum application rates for certain hazards, but then applies higher recommended rates for lower performing foam concentrates. In this way foam users are made aware that if they compromise on the foam concentrate quality they are going to need to apply larger quantities to achieve a similarly effective result. This has associated implications when lower quality foams are selected for larger water demands, bigger water tanks and pumps, larger bore pipework and escalating costs of the project. This is something that has always been the case in practice, but never clearly reflected in a foam system standard like this before. It also helps to ensure the safety of firefighters, and other personnel involved in future fire incidents.

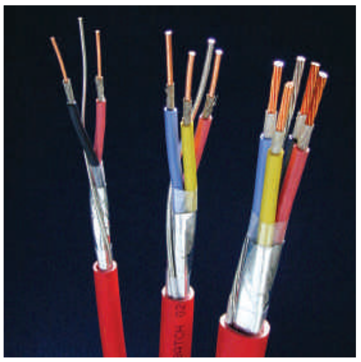
NEW RECOMMENDATIONS

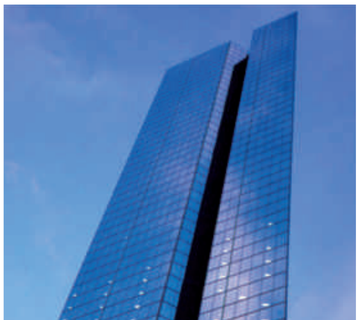
There are also new sections and recommended application rates for large capacity monitor applications on large diameter storage tanks, bunded/diked areas around these storage tests, as well as LNG fires.

The standard also focuses on the importance of system commissioning to verify the system design actually works to produce the anticipated foam coverage and application rate. Routine inspection requirements, maintenance procedures and their frequency are also given careful attention. All of this is based on sound practical experience after many years of rectifying systems in the field, so they can work according to the original specification, simply because no commissioning test or maintenance schedule was required to be done, or often provided at the time of project hand-over.

It is hoped that this new prEN13565-2 foam system standard will be a valuable future assistance to foam users, system design consultants, installation contractors and servicing and maintenance specialists alike. It is intended to ensure that even more effective foam systems are installed in future protecting life, minimising damage to property and helping to keep business interruption to a minimum for all those protecting their vital assets.

We urge all foam users to read this new draft standard once it is publicly released for comment and respond with any observations or practical experiences for technical review. This will ensure the most accurate working document is created that everyone can use to improve fire safety both within the European Union and beyond.





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Quality System
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assessed to BS 7629: part 1
and BS 5839-1: 2002

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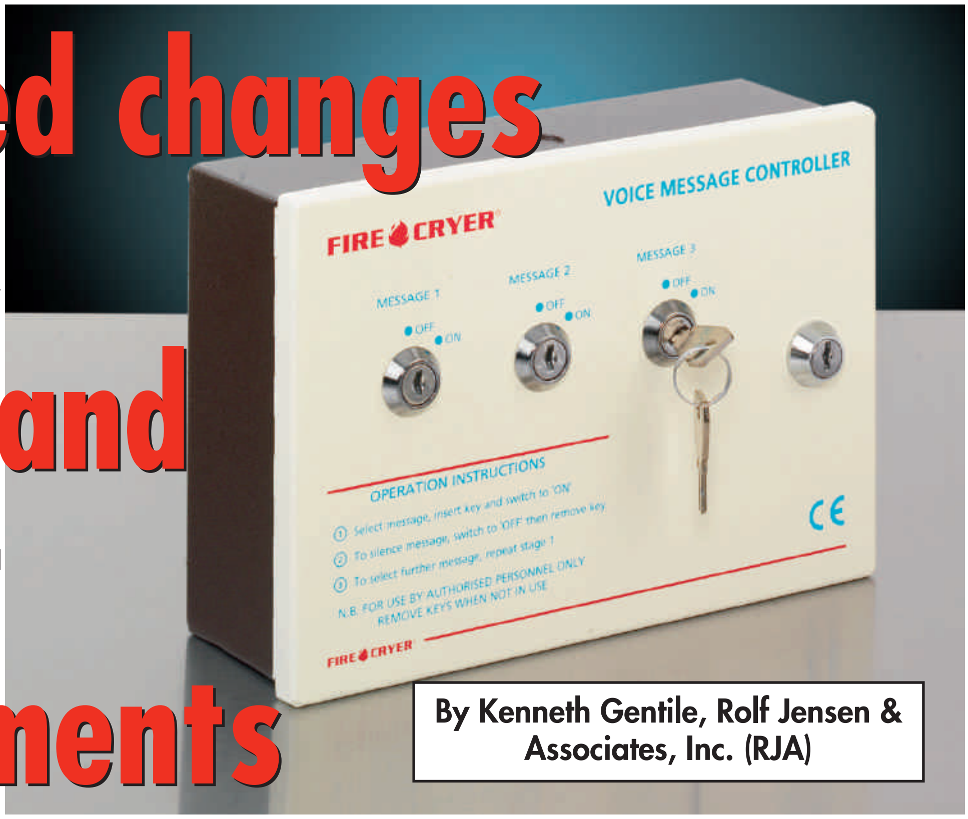
Proposed changes to horn, strobe, and speaker requirements



By Kenneth Gentile, Rolf Jensen & Associates, Inc. (RJA)

Pic courtesy of Vimpex Ltd

IF THERE BE ANY objections, speak now . . . or for three years hold your peace. The season for comments on proposed changes for the National Fire Alarm Code (also known as NFPA 72), 2006 edition has arrived. NFPA 72 is incorporated by reference into most model building codes used in the United States, and by many used internationally. Therefore, as the "comments" period of the NFPA 72 revision cycle is upon us, all parties involved in the manufacture, design, installation, inspection or use of premises fire alarm systems should take note of the developing revisions.

For those not familiar with a few key provisions of the process, National Fire Protection Association (NFPA) Technical Committees, with members representing various fire alarm interests, met this past January to review large volumes of proposed corrections, innovations, and deletions. After much discussion, these proposals have been condensed into smaller volumes of recommended and refined passages. This spring, the association will issue these revisions for public comments in a document known as "Report on Comments" (ROC). This provides a second opportunity for the public to affect the content. Most of the final changes that will be incorporated in the next edition of the National Fire Alarm Code (at the 2006 annual meeting), can be found in the ROC.* All interested persons should certainly review and comment upon the proposed changes to their favorite fire alarm code chapters**. This article, however, will only discuss and summarize the proposed revisions to Chapter Seven, "Notification Appliances for Fire Alarm Systems"***.

For clarification, Notification Appliances are defined in the code as:

> *A fire alarm system component such as a bell, horn, speaker, light, or text display that provides audible, tactile, or visible outputs, or any combination thereof. (NFPA 72, 2002, 3.3.113).*

The purpose and scope of Chapter Seven can be more specifically described as to *"contribute to fire protection by providing stimuli for initiating emergency action and by providing information to users, emergency response personnel, and occupants."* This includes performance and installation requirements for both the familiar evacuation alert devices, and the annunciating equipment, that is increasingly processed from database information on "PC" type equipment.

The technical committee responsible for Chapter 7, designated by the abbreviation "SIG-NAS", has reviewed the proposals received by NFPA with the goal of addressing ambiguities in the 2002 edition, incorporating new developments in technology, streamlining regulatory requirements and correcting style and language.

In addition, to its duties to Chapter 7, SIG-NAS has been assigned a substantial role in the development of a new Annex G. Annex G, "Mass Notification Systems", has emerged largely in response to the attacks in New York and Washington. As an Annex, its provisions are not enforceable requirements, but its provisions will have impact on many high profile buildings, government facilities and military installations for years to come.

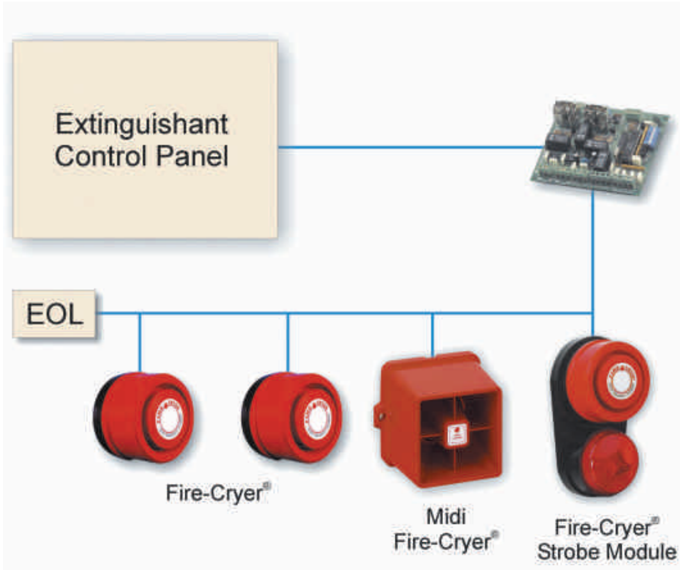
REVISED AND NEW DEFINITIONS

Although definitions are found in Chapter 2, each Chapter Committee has the responsibility for managing the definitions of those terms that are relevant to its own scope.

The SIG-NAS proposals in the ROC include several important new definitions:

- "Wide area signaling." Signaling intended to provide alerting or information to an exterior large open space area, or a large volume space such as a campus, neighborhood, city, town, community or stadium.

This definition is used in the criteria for the Mass Notification Systems of Annex G.



Pic courtesy of Vimpex Ltd

- "Exit Marking Audible Notification Appliances" A supplemental notification appliance that directs occupants toward exits and areas of refuge by the sense of hearing for the purpose of evacuation or relocation.

These appliances are a new, emerging technology that creates a new type of notification appliance. These devices generate a unique audible signal that will help occupants identify the direction of egress. These appliances, also referred to as "directional sounders", utilize advancements in broadband transmission technology to create the directional effect.

Revised definitions include:

- "Occupiable Area" Areas of a facility where people are regularly expected to be present. This includes all public areas.

Revisions to the definition are also accompanied by new Annex passages for clarification. The 2002 edition's definition specifically listed electrical closets, walk-in closets, and similar areas as occupiable areas. By excluding these areas, the new code should eliminate many unnecessary and unreasonable placements of appliances that have been the result of strict enforcement of the definitions. Specifically excluded are interstitial spaces or mechanical rooms, and areas only occupied during specific maintenance operations.

This revision emphasizes that the purpose of NFPA 72 is not to specify where public mode signaling is required. NFPA 72 only provides the criteria for performance and installation of these appliances should visual public mode signaling be a requirement of other codes or adopted legislation.

NOTIFICATION APPLIANCE CHARACTERISTICS

Changes in the requirements for the performance and construction of notification appliances are typically of special interest to manufacturers and system vendors. Among the proposals is the following:

Maximum Audibility

The maximum allowable audibility has been reduced from 120 dBA to 110 dBA to make the NFPA 72 requirements consistent with requirements of the Americans with Disabilities Act.

Regulated Appliance Listings

Language is proposed that explains that regulated notification appliances can be used with panels that are listed to have regulated notification appliance circuits (NAC's). Panels that are listed as having special purpose NAC's must use notification appliances that are identified in the manufacturer's literature.

Firefighter Interface Standard

Revisions to the previous text of 7.10, 2002 edition, that will reference a new NEMA standard for a common firefighter interface. The standard itself is also being considered for inclusion in the Annex of the 2006 edition.

DESIGN CONSIDERATIONS

System designers have a particularly profound interest in both recommended design methods and prescriptive requirements that affect their work. Significant changes include, but are not limited to the following:

Ambient Sound

Annex material (texts that are not enforceable, but are important in understanding the intent of the code) has been revised to emphasize the importance of understanding the ambient noise level in the areas to be provided with audible notification. More specifically, system designers should determine the probable room use or activities when establishing a base ambient noise level. The likely use of permanent fixtures, (such as showers) or temporary equipment (such as vacuum cleaners) must be considered.

Private Mode Signaling

Paragraph 7.4.3.1, 2002 edition that requires a minimum sound level in areas of "Private Mode Signaling" has been deleted. System designers must apply customized solutions when proposing this mode of notification. This paragraph, therefore, was thought to be superfluous since designs for special needs in the occupancies permitted to have "Private Mode Signaling" (such as hospital critical-care units) often require invoking paragraph 7.4.3.3 that permits reduced sound levels where appropriate and approved.

Strobe Synchronization

Strobe synchronization has been a requirement of accessibility and fire alarm codes to prevent incapacitating reactions resulting from errant flashing frequencies. The extent of the synchronization has, at times, been unclear. The 2002 code requires synchronization whenever more than two strobes are in a common field of view. This has been interpreted from extremes where only simultaneously visible strobes must be "synched"; to synchronizing entire buildings because of one multiple strobe

Pic courtesy of Vimpex Ltd

Pic courtesy of Vimpex Ltd

field of view. Some interpretations have even required that strobes must be synchronized if seen simultaneously from outside of the building.

The proposed revisions allow up to two separate groups of strobes to be unsynchronized with each other if visible in a common field of view. Additionally there is added language indicating that strobes within the building do not have to be synchronized for observers outside the building.

Strobe Intensity

System designers have regularly specified strobes with candela ratings in excess of the minimum required for a given room or space. This has been done to assure compliance with ADA and NFPA requirements. Annex language is proposed to clarify that this practice is acceptable.

Strobe Coverage

Placement of visual notification appliances (strobes) to provide compliant coverage is one of the most confusing and contentious issues in any fire alarm system design. Current proposals provide additional information and clarifications to the users of NFPA 72. Commercially available strobe coverage tables have been added to supplement those tables that are already in the code. Annex material has also been added to clarify the intent in some difficult occupancy types (such as "big box" retail).

Strobes in Corridors

Annex material has been added to clarify paragraph 7.5.4.2 of the 2002 edition. Should the room method for placement of strobes be used for coverage in corridors; then an additional strobe is not required to be placed within 15 feet of the ends of the corridor.

MASS NOTIFICATION SYSTEMS

As previously mentioned, a new Annex G is under consideration that would establish standards applicable to Mass Notification Systems (MNS). It should be emphasized that these are optional systems (not currently mandated by any of the major model codes), and that the requirements of the Annex are not enforceable as requirements for the installation of these systems. Nonetheless these systems will become more common in the very near future, and this Annex will influence the development and design of these systems.

The Annex considers an MNS to be a system for distributing information and instructions to people in an emergency. Though the exact definition is undergoing refinement by the Fundamentals Committee of NFPA 72 at the time of the writing of this article, the purpose will be to provide additional information to all affected parties.

SIG-NAS has been assigned the task of reviewing and refining the proposals for the MNS Visible Signaling (G3.6.1). The Visible Signaling devices are lights or strobes that will be energized when the MNS is activated with the intent of directing occupants to seek additional information and instructions. The devices, as such, must be distinct from fire alarm and other visual notification appliances. The necessity of these devices and their locations are subject to the design.

Proposals under consideration for the Visible Signaling Devices affect the following:

- The color of the lens or light flash.
- The labeling or markings of the devices.
- Devices serving multiple purposes.
- Deactivation of simultaneously activated fire alarm visual notification appliances.
- Textural visual devices.
- Light Flash Synchronization.

Readers interested in the development of this standard should be aware that in addition to SIG-NAS, other NFPA 72 Technical Committees are reviewing proposals. These include the committees for fire alarm system fundamentals, initiating devices, protected premises systems, and supervising stations. Parties interested in a complete understanding of the standards should review the ROC for proposals from each of the committees.

SUMMARY

Notification appliances are, arguably, the most noticeable component of the fire alarm system. The performance and placement of these devices is often one of the more expensive and intricate components in the building fire alarm. As a result, designers, installers, local authorities, responding personnel, end-users and the building occupants should take a participatory role in the development of efficient but effective, standards.

The ROC will be issued shortly, and the period for comments is a 60 day period scheduled to end on September 2, 2005. By using the on-line forms provided at www.nfpa.org; individuals and groups can make their concerns and suggestions known. The NFPA code revision process assures that all comments will be reviewed and considered by the committees.

When it is adopted in the spring of 2006, the National Fire Alarm Code and whatever final form the proposed revisions take will be the document governing installations for several years to follow. For those who regularly use NFPA 72, this is the appropriate time for offering constructive comments on the proposed changes.

\Information on obtaining The 2006 NFPA 72 Report on Comments is available at www.nfpa.org.

***Information on specific methods for submitting comments can also be found at www.nfpa.org.*

****Thanks and acknowledgement to Mr. Ray Grill for his assistance in summarizing the extensive discussions of the SIG-NAS Technical committee meetings.*

Mr. Ken Gentile is a consultant with the fire protection engineering firm Rolf Jensen & Associates, Inc. (RJA). Located in their Houston, Texas USA office, Mr. Gentile has extensive experience in the design of fire alarm systems. To learn more about RJA, visit their website at www.rjainc.com

Fire Engineering with Intumescent Coatings on steel

By Wim van Leeuwen

Pic courtesy of Ameron International

WITH THE INCREASED DEVELOPMENT of prestigious constructions and buildings with high architectural design requirements, the protection of exposed steel structures from a possible fire is becoming evermore important.

International designers/engineers/architects and internationally operating building consortia use materials, suppliers and contractors across national borders. Building legislation and fire protection requirements though, despite the development of international standards and test procedures, are often nationally legislated.

Building designs and the fire protection system requirements are therefore often re-evaluated in the tendering and pre-construction phase. At this stage, contractors, design engineers, fire engineers, coating and fire protection specialists may review the specified systems with respect to practicalities around the actual construction and compliance with local national fire regulations.

In the UK for example suppliers of thin-film intumescent coatings can offer advice on intumescent coatings to meet fire safety engineering requirements and the use of elevated critical temperatures in line with BS5950 Part 8 and the Eurocodes. The UK Building Regulations, Approved Document B – 2000 supports the use of fire engineering as an alternative to meeting the guidelines of the approved document.

This allows the designer to use fire engineers to analyze the performance of a steel frame structure in a fire, apply fire engineering knowledge to optimize the design to produce a safe building and reduce steel frame passive fire protection costs. Optimization of the Hp/A (A/V) ratio for selected members can be a worthwhile exercise. By increasing the steel section weight, thereby reducing the Hp/A (A/V) ratio, the intumescent film thickness can be significantly reduced to give an overall cost saving.

The introduction of fire testing research into concrete filling of steel hollow sections by Corus Tubes Division, confirms a significant reduction in Hp/A (A/V). This allows designers to use intumescent coatings as a practical solution on slender steel hollow sections to achieve fire ratings of 2 hours.

Fire engineering of structural steel frames is most suited to large projects where the net commercial benefits are the greatest.

THIN FILM INTUMESCENT COATINGS

The thin film intumescent coatings are commonly used on steel frame structures in commercial, leisure, airports, education, retail, stadia, manufacturing and industrial sectors.

In the past intumescent coatings were used only where the steelwork was visible. This is no longer the case as they are commonly used throughout steel frame structures.

The application of intumescent coatings off-site, prior to steel erection is now an accepted method of application. It is particularly suited to high-rise steel frame structures in city locations. The simple fact that thin film intumescent coatings are the only passive fire proofing method to allow for controllable offsite application has contributed much to its increased use.

In addition the ideal combination of thin film intumescent coatings with the lightweight cellular beam constructions has developed much interest in the market.

The selection of the intumescent coating depends on the environmental conditions in which it is to be exposed

Typical advantages of thin film intumescent coatings over the other forms of passive fire protection:

- More ceiling void space for services passing through or adjacent to steelwork.
- Decorative appearance allows designers to use exposed steel to express the structure.
- Fast application can assist construction programmes.
- Ideal for through fixings required with Mechanical and Electrical services, with no costly repairs.
- Cost effective against other fire protection methods.
- Steelwork may be fire protected before the building is weather tight with suitably formulated intumescent coatings.
- Steelwork may be fire protected off-site prior to erection with external grade intumescent coatings.
- Fire engineering can allow reduction in intumescent thickness by structural analysis of the steel frame design.
- An intumescent system can be easily repaired if damaged.

Why use intumescent coatings on steel beams with holes?

- The use of intumescent coatings on cellular steel beams has become increasingly popular over the past three years.
- In office developments we see cellular beams being utilised for their ability to span wide areas of typically 15-16 m with the openings in the beams adding flexibility for through beam service penetrations.
- The passive fire protection of these beams has been carried out in the past using cementitious spray, fire boards and intumescent coatings.
- When an engineer designs a beam with holes in it he has to design it with a number of considerations in mind. Its structural performance in the cold state; its structural performance in a fire; what size openings to add and on what centres to make the most economical solution for the project.
- Clearly, to design a hole in a steel beam only to close it again with cementitious spray or fire board does not make much sense. At thickness of 0.2 to 2.5 mm, thin film intumescent coatings such as Steelguard FM have a negligable effect on the hole dimension. Steelguard FM can give economical fire protection up to 90 minutes, applied on-site or off-site in the steel fabricators shop This is the main reason that intumescent coatings are the best option to fire protect cellular beams.
- The use of a fire engineered solution for cellular beams is now an important consideration. Bringing together the knowledge from three sectors of the construction industry namely structural engineers, cellular beam manufacturers and intumescent coating manufacturers Previously these sectors have not been working together effectively.
- We have been working with Westok, the inventors of the Cellular beam system, for the last 5 years. In the last 12 months joint testing and research has enabled Westok to offer the construction industry a simple fire design service for cellular beams. We are confident that fire engineered solutions for cellular beams will soon be commonplace in the construction industry.

and whether the material is to be applied on or off-site. The following table indicates environmental types and the associated corrosion risk.

MATERIAL CHOICE AND COMBINATION

With the correct choice of materials, an intelligent combination of different products and minor structure modifications significant construction time and cost can be saved.

An on- or off-site application option can be selected for both the anticorrosive primer system and the intumescent coating system. The optimal selection of weldable pre-construction primers, anti corrosive primers and the application of the optimal intumescent coating system are essential for fluid logistics in the pre-construction and construction stages.

The correct use and combination of anti-corrosive primer and intumescent coating, for interior use or for exterior weathering of exposed structures plus appropriate decorative or weather resistant topcoats, will prevent early coating damage during the construction phase and ensure lasting corrosion resistance and fire protection.

COATING CHOICES

Specifiers and contractors must choose the appropriate coatings to ensure construction integrity, corrosion protection, weathering resistance, fire resistance and appropriate decorative finish aspects. Optimal products must be selected with regard to their individual performance aspects such as weldability and corrosion resistance throughout the construction period for a pre-construction primer. With the correct product selection and system combinations the corrosion resistance and weather stability of both the steel primers and the intumescent coatings can be ensured.

In various European countries the use of solvent-based coatings is restricted by limitations of the solvent content in the product formulations. On occasions the use of solvents in enclosed buildings is even completely prohibited, which means water borne primers, intumescent coatings and topcoats will have to be selected. Obvious limitations from the use of water borne coatings may then influence the choice between on- or off-site coatings.

CONSTRUCTION ASPECTS

Even when the design of the steel frame is complete there may be situations where variations in the choice of steel dimensions are still possible at a late stage. Small variations in steel choice may change loading factors or fire stability aspects that will allow for more practical protection materials.

Complex constructions with a wide variety of different steel sections may be rationalised to give a more uniform banded intumescent coating thickness range with a slight over-design of the protective system. This can reduce the application time because the application is less complex and the quality control supervisor's job is simplified enormously.

Identifying variations in actual critical steel temperatures in building compartments and between different sections in the construction may further reduce or simplify the protection systems.

In co-operation with local fire authorities, test institutes and fire protection regulators it may be valuable to carry out a specific fire test or carry out a specific assessment for certain steel members of the construction.

The correct combination of anti-corrosive coatings, intumescent products and topcoats is essential. Also the combination with specific steel sections may be reassessed to come to an optimal combination of materials. Where possible this should be supported by durability testing, weathering testing and subsequent fire testing with third party accreditation.

QUALITY CONTROL AND INSPECTION

The quality control and inspection of intumescent coatings is vital, as with all fire protection methods it is a "life safety" issue. As passive fire protection performance is dependent on correct application, the intumescent system film thickness inspection is critical at all stages. Simplification to sections with uniform specified dry film thicknesses greatly simplifies inspection and corrections while reducing application and measurement errors.

Typical systems differentiated to European Corrosion classes

Environment ISO 12944	Application	Primer	Intumescent	Top coat
C1	On-site	Epoxy Zinc phosphate 75µm dft	General purpose or waterborne products	Optional requirement
C2	On-site	Epoxy Zinc phosphate 100µm dft	Solvent based products for exterior use	Acrylic or Polyurethane at 50µm dft
External C3/C4	On-site	Zinc epoxy 75µm dft	Solvent based products for exterior use	Acrylic or Polyurethane at 125µm dft
C1	Off-site	Epoxy shop primer 25µm dft	Solvent based products	Acrylic or Polyurethane at 50µm dft
C2	Off-site	Epoxy Zinc phosphate 100µm dft	Solvent based products for exterior use	Acrylic or Polyurethane at 50µm dft
External C3/C4	Off-site	Zinc epoxy 75µm dft	Solvent based products for exterior use	Acrylic or Polyurethane at 50µm dft at works plus 75µm dft at site

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Fixed fire pumps and controllers

By Alex Playfair, Business Manager of SPP Pumps Ltd

Pic courtesy of SPP Pumps Ltd

IT IS WIDELY ACKNOWLEDGED that the fire pump is the heart of water based fixed fire protection systems but it should also be accepted that the fire pump controller provides the logic control and monitoring for the system.

The prime function of the controller is to monitor the status of the fire main and the power supply integrity. The controller will automatically initiate a start of the fire pump set upon receipt of a signal from the fire system that indicates that a fire has started. In most cases, this from a pressure switch, indicating that the pressure has dropped to a predetermined level in the fire water pipe work. Small pressure losses, usually caused by leaks are made up by a small pressure maintenance pump. When this pump or in some instances, pressure vessel can not re-establish the pressure loss in the fire main, then the pressure will continue to drop. This should be as a result of the system taking water for the fire application. The fire pump controller will immediately start the fire pump to satisfy any water requirements up to the maximum design demand required by the system. The pump runs out on its curve to the point where it satisfies the system demand and the static and friction loss in the fire system. The pump can also be initiated from a detector or even a manually actuated signal from an operative.

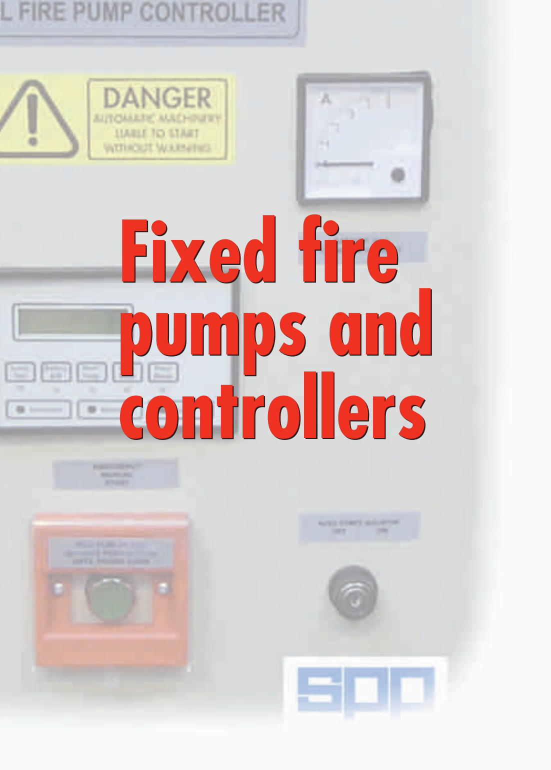
Most standard industrial starters and engine controllers satisfy the simple criteria of starting the unit but the fire system demands specific needs to guaranteed the reliability of a package that is designed to save lives and property.

In the case of European EN 12845 systems the electrically driven fire pump has a number of critical conditions that must be monitored to ensure reliable pump operation.

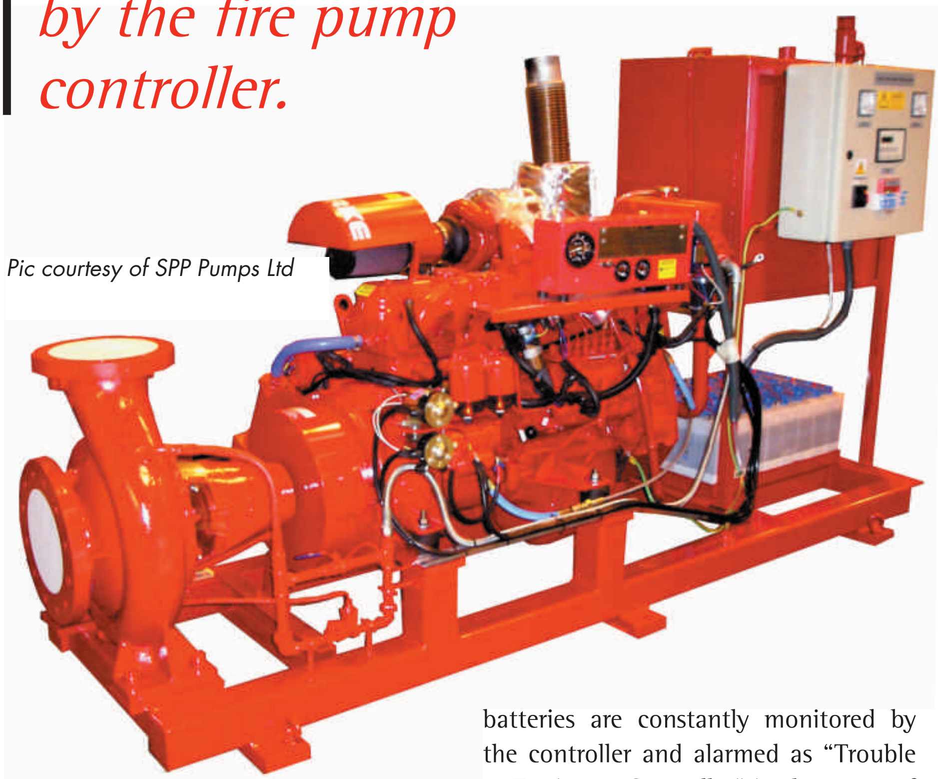
The supply to the pump controller shall be solely for the use of the sprinkler pump set and separate from all other connections, ideally being taken from the input side of the main switch on the incoming supply to the premises, thus ensuring that any

Most standard industrial starters and engine controllers satisfy the simple criteria of starting the unit but the fire system demands specific needs to guarantee the reliability of a package that is designed to save lives and property.

Fixed fire pumps and controllers



The monitoring of the power available to the motor on all three phases, pump on demand, pump running and start failure are all obligatory and provided by the fire pump controller.



Pic courtesy of SPP Pumps Ltd

electrical fault within the installation will not deprive the sprinkler pump motor of its supply.

The monitoring of the power available to the motor on all three phases, pump on demand, pump running and start failure are all obligatory and provided by the fire pump controller. It is critical to constantly monitor the supply phases to ensure the integrity of the electrical supply. Pump on demand monitoring is needed to indicate that the pump has received its signal to start. The controller also monitors pump running and Start failure. All the monitored conditions are visually indicated in the pump room and at a permanently attended remote location. Pump running, power failure and start failure are also audibly indicated at the remotely monitored area.

On diesel engine driven units the use of any switch that prevents the engine starting automatically is monitored. This may be the main isolating switch on the panel or a selector switch turned to the manual start position. The failure of the engine to start after it has run through its six-attempt cycle, pump running and any fault at the engine or controller must also be monitored. These signals must be indicated both locally at the panel and remotely at a manned station.

Diesel engine controllers incorporate dedicated battery chargers to maintain the charge on the engine starting batteries, the performance of the battery chargers and the charge level of the batteries are constantly monitored by the controller and alarmed as "Trouble at Engine or Controller" in the event of voltage levels falling to critically low conditions.

The controller also monitors the engine coolant temperature and lubrication oil pressure when the engine is in operation, any critical condition will be alarmed as "Trouble at engine or Controller", the engine will continue to run unless operator intervention occurs.

The failure of the engine to start after it has run through its six-attempt cycle, pump running and any fault at the engine or controller must also be monitored.

Pic courtesy of SPP Pumps Ltd

Full-scale mobilisation

Heavy exhibitor response

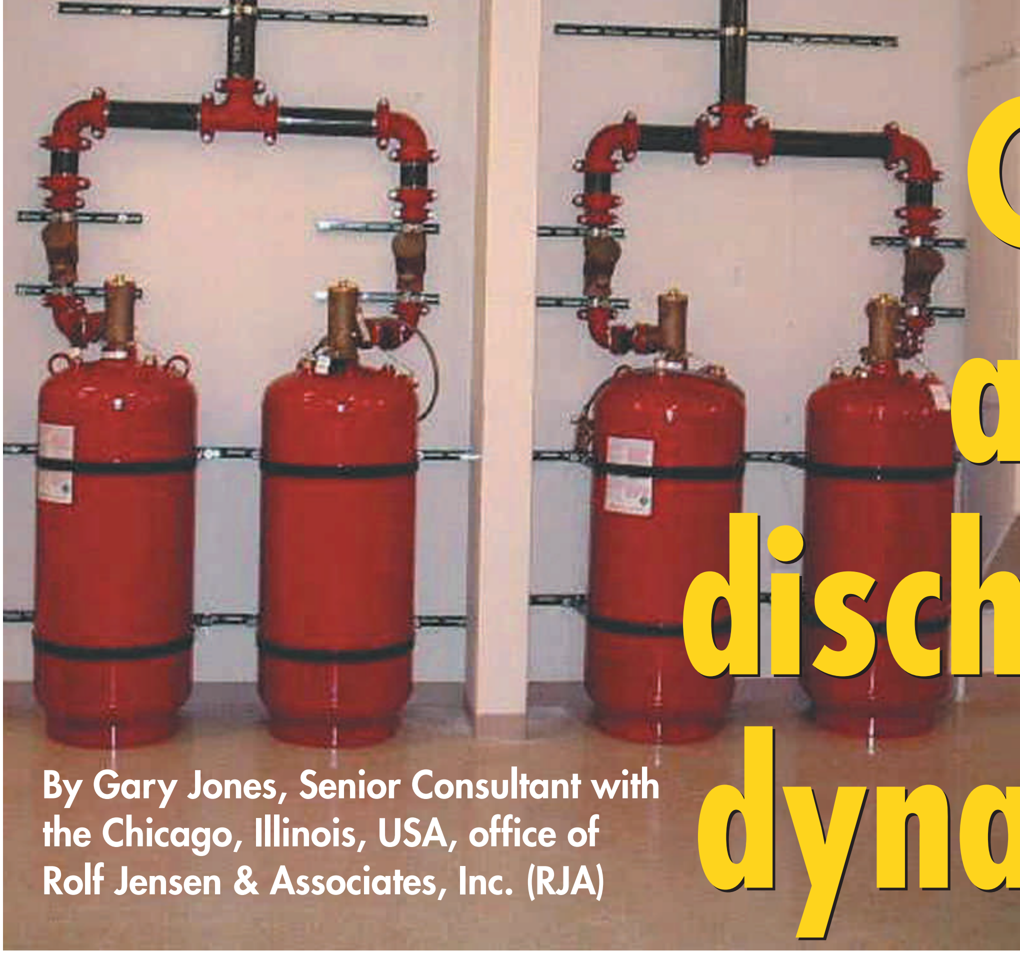
Things are booming at INTERSCHUTZ 2005. For months now, the trade show team has been involved in a full-scale mobilization. “We’re delighted at the response, especially from outside Germany,” reports a member of the INTERSCHUTZ project team. All the market leaders have already registered for the “International Exhibition for Rescue, Fire Prevention, Disaster Relief, Safety and Security” at the Hannover Exhibition Center, running from 6 to 11 June 2005. Leading companies from Sweden, Spain, Portugal and Poland will be represented in Hannover for the first time ever. All in all, the organizers at Deutsche Messe AG are expecting to draw over 1,000 exhibiting enterprises, institutions, organizations and associations for the exhibition, occupying halls 12, 13, 26 and 27 at the exhibition center, as well its the open-air site.

Running parallel to INTERSCHUTZ in its debut showing is the INTERPOLICE show – the “International Exhibition for Police and Internal Security.” Located in Hall 27, this show features around 200 exhibitors offering an extensive survey of all the latest processes and innovations involving police work and security operations.

The issue of “Safety & Security” will enjoy a high priority at both of these international events, having even been made into an independent exhibition sector there.

Another key feature of the 2005 event is its unique mixture of exhibition, specialist forums, special events and live happenings. Industrial exhibitors and non-commercial exhibitors will once again rub shoulders and create an ideal mix. For the first time ever, the event will feature four so-called “Theme Days”, revolving around the topics of home security, industrial safety, airport security and road and railway safety.

For more information on exhibiting or visiting Interschutz 2005 please visit www.interschutz.de



Clean agent discharge dynamics

By Gary Jones, Senior Consultant with the Chicago, Illinois, USA, office of Rolf Jensen & Associates, Inc. (RJA)

Pic courtesy of RJA

WHEN A GASEOUS SUPPRESSION system discharges, many of the protected area ambient physical environmental properties are influenced in a relatively short time frame. These physical properties can include temperature, pressure, visibility and air quality. This article will focus mainly on the physical changes that may occur within a protected area due to the introduction of a gaseous agent into the ambient environment.

CLEAN AGENT COLLATERAL ACTION

The agent acts or reacts on the fire. What else happens?

Not many of us have had the opportunity to actually be inside a protected area when an actual (unplanned) or controlled (test) discharge occurs. Those of us that have were probably involved in observing various other system operations and may not be aware of some of the physical changes taking place. In order to determine what other events or changes occur, we must rely on data developed during system testing of the various agents. Comprehensive system discharge testing is rare these days for various reasons and, unfortunately, there seems to be a limited amount of published discharge test data that is readily available.

The last full scale and comprehensive multiple clean agent fire tests that I am aware of occurred back in 1996. Halon 1301 and many of the now available clean agents were tested under identical conditions in various fire and non-fire scenarios. This testing was performed at the Loss Prevention Council (LPC) in the United Kingdom and included the following agents; Argotec, Argonite, Inergen, FM-200, CEA-410, FE13, NAF SIII and Halon 1301.

All testing was conducted utilizing the same test protocol and enclosure for each agent. The test enclosure was fitted with sensors to monitor and record the enclosure pressure and temperature changes during a discharge. In addition, sensors were provided that measured for the presence of chemicals generated as a result of agent decomposition and a light source and photocell arrangement measured the degree of obscuration from smoke and agent fogging. Tests were performed without a fire present (cold discharge test) and extinguishing tests were performed on different type and size fires. The ability of the agents to suppress the fires was documented and the test enclosure pressure, temperature, obscuration and chemical content was monitored and recorded for each individual fire test for each individual agent.

I have chosen to use the LPC "Halon Alternatives" Test Report as the main reference basis for this article because the test report suggests the tests were very detailed, well planned and thoroughly documented. In addition, the LPC, an independent testing body, managed and documented the testing.

ROOM TEMPERATURE

The LPC Report test data suggests the ambient room temperature changes significantly when a halocarbon agent discharges. A temperature change also occurs during an inert gas discharge but to a much lesser degree. The rapid expansion or change of state of a halocarbon liquid as it flashes to a gas at the nozzles absorbs a tremendous amount of heat. This heat absorption strips the heat from the space and quickly lowers the temperature within the protected area.

For the cold discharge tests (no fire)

Clean agent discharge dynamics

performed, the test enclosure temperature was preconditioned to 18–22°C (64.4 to 71.6°F) prior to beginning a discharge test and the minimum room temperature reached was documented in the report. One cold discharge test of FM200 at a design concentration of 7% resulted in a minimum room temperature recorded of 1.50°C (34.70°F). The minimum temperature resulting from an Inergen gas discharge was 15.22°C (59.4°F). Comparing the old with the new, Halon 1301 at a 5% concentration created a minimum temperature of 9.28°C (48.7°F).

It must be noted that these tests were performed in a room with no heat load or heat generating equipment and no heat generating fire present. Minimum temperatures were not recorded for the actual fire tests. However, the negative pressures observed for the various halocarbon fire tests suggest a cooling effect still occurs. The temperature fluctuations would more than likely be influenced by a room full of data processing equipment generating heat at a 100 watts per square foot rate.

From a system operational or extinguishing standpoint, room temperature reduction does not affect the performance of the agent but it could have an impact on sensitive electronic equipment installed within the protected area due to thermal shock. It would be prudent to inform the protected space owner or end user of this likely discharge "side affect" during the system design and agent selection stage. The agent manufacturer should be able to provide additional information on temperature drops for various room heat loads. A determination could be made early on if the equipment installed within the space can tolerate a possible thermal shock of some magnitude.

ROOM PRESSURE

Whenever the volume of air or other gases within a partially sealed room, enclosure or protected space is changed, a difference in pressure will occur between the enclosure inside wall, ceiling and floor surfaces and the opposite side of these surfaces. Small pressure differences are common and go unnoticed because they are usually not detectible or obvious. One example of an intentional small pressure difference is positive pressure for a data center or computer room. These rooms are usually designed to operate at a slight positive pressure in order to limit or reduce any dust, dirt or other non-clean air from entering the space. A controlled amount of fresh air is introduced into the space and a slightly lesser amount of air is allowed to return from the space. This difference in air flow creates a positive pressure within the space and helps to keep the space environment clean. When larger differences in air flows into and out of a space occur, the pressures can increase significantly.

Nature and the laws of physics are always working hard to keep all forces or energy in balance or equilibrium. The injection of gaseous suppression agents into a partially sealed enclosure upsets this balance and will create pressure differences at the enclosure perimeter structure. The amount of pressure developed is influenced by the discharge flow rate of the agent, the cooling effect of the agent and by the rate air is allowed to travel from the space to atmosphere and vice versa. The faster an agent is delivered to a space, the higher the potential pressure difference between the space and atmospheric pressure. The easier air is allowed to flow into and out of a space, the lower the pressure difference. Depending on the agent, negative pressures can develop within the space during a discharge due to the cooling effect of agent evaporation. Since cold air occupies less space, air will be drawn into an enclosure during a discharge unless the positive pressure generated by the agent flow rate offsets the negative pressure created by the temperature drop.

NEGATIVE PRESSURE

Agents stored as a liquid tend to absorb more heat from the space as the liquid flashes to a gas at the discharge nozzles. These agents will generate negative pressures within a protected space when discharged. For example, Halon 1301 is stored as a liquid and does produce a cooling effect within the space. The LPC test data for one Halon 1301 cold discharge test (at 5% design concentration) indicated a negative pressure of 200 Pa

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Clean agent discharge dynamics

(4.18 lbs/sq ft) at approximately 2 seconds into the discharge. The halocarbon clean agents tested all developed higher negative pressures due to increased concentration levels and chemical makeup. Agents stored as a compressed gas, such as Inergen, did not produce any measurable negative pressures during the tests. It must be noted that the Halon 1301 negative pressure of 200 Pa (4.18 lbs/sq ft) was realized in an enclosure that included a designed (by vendor) pressure venting system to limit or control the enclosure pressures.

POSITIVE PRESSURE

All gaseous agents will produce positive pressures within the protected enclosure when discharged. This pressure generated is pure physics and cannot be avoided. Fortunately for all of us, pressures can be controlled.

By far, the inert gas agents, Inergen, Argonite and Argotec have a greater potential to develop high positive pressures within a protected enclosure. Halocarbon agents can also produce significant positive pressures, but with less potential due to the reduced design concentration levels as compared to the inert agents. Ansul has developed and has had pressure venting guidelines for their Inergen agent for some time. Some of the main distributors for FM200 have also recently issued venting information on their products. Why the concern for pressure build up in the space? These pressures, if not controlled, can cause damage to the enclosure and possible personnel injury.

How much pressure can be tolerated? Each protected enclosure can withstand a certain amount of pressure difference safely depending on how it is constructed. Ansul's venting guidelines indicate an enclosure strength of 5lbs./sq. ft. should be utilized in their venting calculations if the actual room strength is not known. If the enclosure pressure exceeds the capability of the structure, the structure will likely fail. Failure will always occur at the weakest point of the structure since the internal space pressures are equally exerted on all surfaces with atmospheric pressure on the opposite side of the surface. Failure may be a breach of a gypsum board wall at a corner joint or fracture of a concrete masonry unit (CMU) wall.

Many of the agents tested produced enclosure pressures greater than 5 lbs/sq. ft. during the cold discharge tests. Pressures recorded for some of the fire tests were higher than those realized during the cold discharge tests. Again, it must be noted that the test enclosure was equipped with a venting system designed to limit these pressures.

> *Ansul has developed and has had pressure venting guidelines for their Inergen agent for some time. Some of the main distributors for FM200 have also recently issued venting information on their products.*

AGENT STORAGE TANK SAFETY

All gaseous agents noted are stored in steel tanks under significant pressure. The Inergen BAR 200 tanks are pressurized to 2900 psi at 70°F. Halon and FM200 are stored at about 361 psi. These storage tanks, if not handled safely, can and have become traveling "missiles", causing damage and personnel injury.

Each storage tank comes factory equipped with a protective cap over the release valve and a protective "shipping" cap over the discharge port. Only when the safety caps are installed or when the tank is attached to the system piping and mechanically secured, are the tanks safe. Tanks should never be handled unless these safety steps are taken. Technicians must be very careful during the time period when the discharge port cap is removed and the tank is not yet connected and secured to the piping system. A mishap at this time can be disastrous.

ROOM VISIBILITY

Some of the agents produce a "fogging" effect during discharge due to the rapid expansion of the agent at the discharge nozzles resulting in visual obscuration within the space. During the cold discharge tests, the inert agents produced the least degree of visual obscuration. Of the halocarbon agents, Halon 1301 produced the least degree of obscuration and cleared quickly. NAF SIII and FM200 produced high levels of obscuration which remained for a substantial period of time.

These results suggest that the room visibility will likely be affected during a system discharge, with the inert agents having the least impact. With reduced visibility, personnel egress could be impacted if personnel are present within the space at the time of discharge.

AMBIENT AIR QUALITY

When a system discharges, the rapid air movements occurring will dislodge any dust or dirt accumulations, especially in

Pic courtesy of RJA

raised floor cavities that are not cleaned properly. These particles will become airborne, spread throughout the enclosure and finally settle after the event is over. Any cutting oil or dirt/debris left in the piping system will find its way into the room and onto any sensitive equipment, possibly causing contamination. Although there are standards in place to guard against this from occurring, it is sometimes overlooked. It only becomes known after the first system discharge when the agent actually "cleans" the pipes.

During the halocarbon discharge test involving a fuel fire, all agents were partially consumed resulting in chemical decomposition or breakdown products. This chemical breakdown occurs as the agent is exposed to the elevated fire temperatures and produces amounts of hydrogen fluoride in the process. Hydrogen fluoride, being acidic in nature, has the potential to damage sensitive electronic equipment and can be harmful to humans. Halon 1301 consistently produced the least amount of hydrogen fluoride during the fire tests. However, Halon 1301 also produces hydrogen bromide as a byproduct of decomposition which is also acidic in nature.

Chemical decomposition terminates when the fire is extinguished and the fuel is cooled. Often with electrical fires however, where the ignition source remains energized and at very high temperatures, can continue producing chemical decomposition even with the fire extinguished. However, the effect is limited to the area or boundary of the agent and the heat source. Still, it is a consideration that must be accounted for and it may be wise to power down equipment where possible. Powering down electrical equipment involved in a fire has two major benefits; chemical decomposition terminates and the ignition source is removed. The suppression agent extinguishing properties do not last indefinitely and if the ignition source, fuel and oxygen are still available in an agent depleted atmosphere, the fire may reignite.

CONCLUSIONS

From a strictly mechanical standpoint, gaseous suppression systems are relatively simple. The detection system detects heat, smoke or radiant energy, the agent is released and the agent suppresses the fire. However, from a system dynamics standpoint, these systems are relatively complicated. Halon 1301, by far, was the agent that outperformed all the LPC agents tested in every measured category. With manufacturer support of new Halon 1301 equipment and systems now limited to nonexistent, the industry must rely on the available replacement agents for new installations.

Many things must be considered in order to have an effective and reliable gaseous fire suppression system, beginning with agent selection:

- Protected enclosures have to be evaluated for strength and leakage.
- Pressure venting systems, where needed, should be carefully designed so they operate properly and remain reliable over the life of the system.
- Detection and release strategies have to be evaluated and tailored to the specific application.
- Discharge temperature and acidic/corrosive side effects should be discussed with the owner or end user and evaluated.
- A means to exhaust these chemicals should be evaluated.
- Personnel safety and training requirements should be implemented.
- Egress plans should be developed.

In summary, the entire system design or system design specifications should be developed by individuals or consulting/engineering firms with complete knowledge of all the system operating parameters and dynamics. If evaluated, specified, designed and installed correctly, gaseous suppression agents can provide the effective fire protection that owners and end users expect from the industry.

Halon 1301 consistently produced the least amount of hydrogen fluoride during the fire tests. However, Halon 1301 also produces hydrogen bromide as a byproduct of decomposition which is also acidic in nature.

REFERENCE MATERIAL

Loss Prevention Council
Halon Alternatives
A report on the fire extinguishing performance characteristics of some gaseous alternatives to Halon 1301 July 1996

Gary Jones is a Senior Consultant with the Chicago, Illinois USA office of Rolf Jensen & Associates, Inc. (RJA). Mr. Jones has over twenty years experience in the design and application of clean agent, suppression, and fire alarm systems. To learn more about RJA, visit their website at www.rjainc.com

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Bringing order to the and penetration se

Pic courtesy of ASFP

FIRE PROTECTION IS INTENDED to preserve life and property and effective fire-stopping in fire resisting separating elements, plays a critical role in containing a fire at its source, thereby reducing its effect on the primary building structure.

The degree of spread is controlled by creating fire-resisting compartments, which subdivide the building. However, a major threat from fire in most building structures occurs where concealed cavities between fire separating walls and floors are interlinked. It is therefore essential that all openings and gaps are fire-stopped to restrict lateral and vertical fire spread and to achieve the required degree of containment. Failure to do so may cause fire to spread uninterrupted through the cavities and penetrations of a building.

By Graham Ellicott, Chief Executive, Association for Specialist Fire Protection (ASFP)

Mechanical and electrical services, by necessity, breach compartment walls and floors and if not subsequently fire-stopped, the gaps will undermine the compartment's integrity and insulation. Fire-stopping products must be able to provide sufficient insulation to the penetrating services in order to reduce the temperature rise along conductive materials, in accordance with the required insulation criteria of the fire separating element. The movement of smoke is also often an under-rated feature of fires and needs to be carefully considered when specifying fire-stopping constructions.

The 'Guidance' introduction in Approved Document B3 (Internal fire spread (structure)) of the Building Regulations 1991 for England and Wales states, among other requirements, that:

'In the Secretary of State's view, the requirements of B3 will be met:

a if the loadbearing elements of structure of the building are capable of withstanding the effects of fire for an appropriate period without loss of stability,

b if the building is sub-divided by elements of fire resisting construction into compartments

c if any openings in fire-separating elements are suitably protected in order to maintain the integrity of the element (i.e. the continuity of the fire separation); and

d if any hidden voids in the construction are sealed and subdivided to inhibit the unseen spread of fire and products of combustion, in order to reduce the risk of structural failure, and the spread of fire, in so far as they pose a threat to the safety of people in and around the building.'

(Page 61 of Approved Document B3 – The Building Regulations 1991 2000 Edition).

Section 11.2 of Approved Document B3 goes on to say: 'If a fire separating element is to be effective, then every joint, or imperfection of fit, or opening to allow services to pass through the element, should be adequately protected by sealing or fire stopping so that the fire resistance of the element is not impaired'. (Page 79 of Approved Document B3 – The Building Regulations 1991 2000 Edition).

Section 11.12 adds, under the heading of 'Fire-stopping', a requirement that: 'Joints between fire separating elements should be fire stopped and all openings for pipes, ducts, conduits or cables to pass through any part of a fire separating element should be:

- kept as few in number as possible and
- kept as small as practical
- fire-stopped (which in the case of a pipe or duct, should allow for thermal movement)'

(Page 80 of Approved Document B3 – The Building Regulations 1991 2000 Edition).

Due to the historic absence of standardised test methods, the tests and subsequent appraisal of systems used for penetration seals are subject to widely varying interpretations. This inevitably leads to confusion for the specifier, the specialist fire protection contractor, the system manufacturer and the end user, which may lead to installations unable to provide the required standard of protection.

fire stopping al market!

Just one month following the launch of the second edition of the 'Red Book', more than 450 downloads have been accessed from the Association's website.

There are a wide range of materials and systems available which, if correctly specified and installed, will prevent the passage of flame/heat and smoke from passing through a service opening, or joint, for the required period of time. In many cases, however, the sealing or fire stopping of openings or joints in elements of structure are treated as an afterthought and are not given the degree of importance essential for fire protective constructions. There have been many cases where loose materials have been indiscriminately packed around services in an effort to seal the opening, but such installations would invariably perform inadequately in the event of a fire.

In order to bring 'as level a playing field as is currently possible' to the UK market, the Association for Specialist Fire Protection (ASFP) decided almost two years ago to issue a second edition of 'Fire Stopping and Penetration Seals for the Construction Industry', known colloquially as the 'Red Book'. This new edition differs from the first. Like its well known stable mate 'Fire Protection for Structural Steel in Buildings' (also known as the Yellow Book), it now contains products that have been assessed by an independent technical review panel. The 'Yellow Book' is long-established and referred to as a source of information in Approved Document B of the Building Regulations

Just one month following the launch of the second edition of the 'Red Book', more than 450 downloads have been accessed from the Association's website.

The extensive 234-page publication, produced in conjunction with the Fire Study Test Group (FSTG), is split into two parts and is designed to be the definitive guide to the provision of proprietary fire stopping and penetration sealing materials and systems. The first part looks at Regulations, requirements, testing and appraisal principles, while the second part lists nearly 100 proprietary systems that have been evaluated by an independent technical review panel.

Section one of the first part contains background information into why fire stopping is required in general and in particular with regard to the needs of the Building Regulations. Section two outlines procedures for fire resistance test and assessment procedures using UK and European methods. Section three explains the use of the document and types of penetrations and joints, together with some excellent graphical representations and section four contains generic information on the various types of fire stopping materials available. The second part provides the system datasheets.

The FSTG has strongly supported the publication of this edition of the 'Red Book' since it provides specifiers and regulatory bodies with an independently validated, comprehensive and concise guide to the performance of materials used to provide fire protection for the fire stopping and sealing of penetrations in fire rated barriers.

Copies can be obtained via the ASFP web site at www.asfp.org.uk or in hard copy format (cost £50) from the ASFP at Association House, 99 West Street, Farnham, Surrey GU9 7EN. Tel: 01252 739142. Fax: 01252 739140. Email: info@associationhouse.org.uk

Innovations in fire system technology

By Peter Cook, Cooper Lighting and Security Ltd.

The latest generation of Menvier smoke detectors use a purpose-designed light-pipe to enable the detector's alarm LED to be seen from any direction

THERE IS A VAST array of fire detection systems and devices on the market today, ranging from the relatively simple to the most technically sophisticated. Modern automatic fire detection systems are available in two types – conventional and analogue – which, broadly speaking, are used in smaller and larger installations respectively.

Conventional systems use a two-wire radial circuit for each zone and are based on simple on/off switching technology first introduced in the 1970s. Although modern components and good system design can go some way to reducing potential problems, it is not uncommon for conventional systems to generate unwanted alarms due to transients, detector and circuit faults, and certain operating conditions.

A key development aimed at preventing such unwanted alarms has been the multi-criteria detector. Traditionally, detectors were designed to respond to particular fire phenomena such as heat or the presence of smoke. However, many manufacturers now offer multi-criteria devices, which typically contain both an optical sensing element and a thermal element. The fire alarm decision is taken by analysis of the responses from both elements, and this results in improved detection performance.

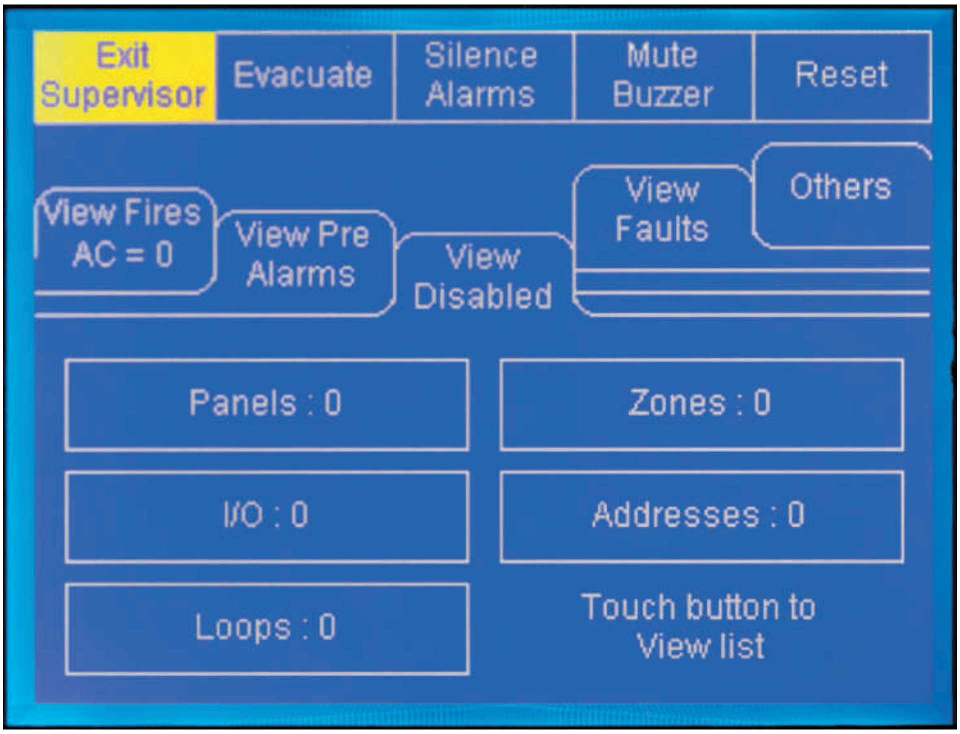
Despite such advances, conventional systems are still unable to match the performance of analogue technology and in some cases they may also work out more expensive. The purchase price of a conventional system may appear attractive, but the amount of cabling required for each detector and alarm spur can be substantial, so the installation costs can rapidly outweigh this initial advantage.

ANALOGUE SYSTEMS

For fire protection applications demanding both high reliability and performance, the more technically sophisticated and versatile analogue systems provide a clear advantage, despite a higher initial equipment cost.

Unlike conventional systems, analogue detection and alarm systems are not based on simple two-state binary detectors, but on 'intelligent' sensors within a software-based communications system. Each fire-detecting sensor

For fire protection applications demanding both high reliability and performance, the more technically sophisticated and versatile analogue systems provide a clear advantage, despite a higher initial equipment cost



The new Menvier DF6000 fire detection system incorporates a large touch-screen display that also acts as a multifunction keypad

or call point is electronically coded with a unique identification or 'address', and detectors and call points are wired in a single loop instead of the two-wire spurs used in a conventional system.

With typically up to four loops fed from a single control-and-indicator panel, the 'analogue addressable' system uses a low-power pulsed signal to interrogate each detector in turn, comparing the reply with data representing a normal, healthy condition within individually programmed limits. For the largest sites, several systems can be linked to form a complete local area network providing total coverage.

As well as dramatically reducing false alarms from transients or faulty circuitry, analogue addressable fire alarm systems can provide a far higher and more versatile degree of protection. Detectors can often be individually programmed for sensitivity or automatically switched between high and low alarm thresholds or even different detection modes – e.g. for night or day protection. The most sophisticated analogue systems can be interfaced with building management systems and can also be used to interact with other services such as ventilation or warden call systems.

The challenge for analogue addressable fire system technology has been to combine its advanced features with the simplicity of operation demanded by today's building users and the straightforward installation procedures that help to make the contractor's task much easier. Now appearing on the market is a new generation of fire detection systems that have succeeded in rising to this challenge.

Menvier callpoints are available in a variety of styles

ADVANCED FEATURES

The latest analogue addressable fire detection systems are generally available in single-, two- or four-loop versions, with each loop capable of accommodating typically up to 150 addresses (although EN54 places restrictions on the total number of devices connected to individual panels). In some cases, up to 63 panels can be networked together to form a single system capable of operating with over 32,000 devices.

Some new-generation systems have the ability to support highly complex sounder ringing pattern requirements. Multi-stage cause-and-effect programming is possible, whereby each addressable sounder or output interface can be programmed independently if required and can be set to respond to specific addresses, specific detection zones or specific panels on a networked system.

Three separate stages of programming per sounder are supported by some leading-edge systems, and each stage can be triggered differently. For example, if a single detector is triggered, the system can be programmed so that the sounder nearest to the detector operates immediately and continuously, while the remaining sounders in the affected zone operate in a pulsed mode, and the other sounders delay for a selectable period to allow the cause of the alarm to be investigated before global ringing commences.

Modern fire systems use a variety of components, and these should all be sourced from the same manufacturer to ensure compatibility

SIMPLICITY OF OPERATION

At the heart of all fire systems is a control-and-indicator panel. Technology advancement has enabled major improvements to the manner in which the user interacts with the system. For example, systems are now available featuring large (120 x 90mm visible area) touch-screen displays. As well as providing detailed system-status information, such displays also act as multi-function keypads, and this versatility enables an extensive array of user and engineering facilities to be incorporated into the panel while at the same time making it easy to operate.

Menvier fire detection systems offer a choice of conventional or loop-powered sounders

On more basic systems, the user is limited to a small number of dedicated pushbuttons, and consequently system interaction is restricted and complicated.

The touch-screen displays on the more advanced systems provide context-sensitive help information throughout their control menus to assist those who are unfamiliar with the system, so most users can add or remove devices or change device text via the panel without the need for a service engineer to visit the site. On some systems, the touch-screen display automatically reconfigures to suit the selected function – for example, if a ‘Change Device text’ menu option is selected, the touch screen would be automatically formatted as a full QWERTY keyboard to enable fast and simple text entry.

Most panels also incorporate conventional zone indication LEDs and system-status LEDs, which can readily be understood even by non-technical users.

STRAIGHT FORWARD INSTALLATION

On some of the latest fire detection systems, the installation and commissioning process has been greatly simplified by the use of spur-tolerant soft addressing. This technology allows the control panel to automatically scan the detection loops and allocate each device with an address number corresponding to its position on the loop, thus avoiding the traditional need for manual addressing of devices, which is not only time consuming but also a potential source of errors.

Another major innovation is the ability to utilise a spur isolator to connect a spur of analogue devices to the main loop. During the soft addressing process, whenever the panel detects a spur, it breaks from allocating address numbers to the loop-wired devices, allocates address numbers to each of the devices on the spur in sequence, and then continues to address the devices on the main loop.

ANCILLARY DEVICES

The range of ancillary devices available varies from one system to another, but typically it will include optical, ionisation, photo-thermal and heat detectors; callpoints in various styles; a choice of conventional and loop-powered sounders and beacons; low-cost passive repeater panels; and a wide variety of input and output interfaces.

Manufacturers of top-flight systems ensure that each of these components has been specifically designed to operate as part of the system, providing an assurance that the panel, the detectors, the interfaces and the ancillary devices are all fully compatible with each other and that the full range of system functionality is supported by each device.

CONCLUSION

The latest generation of analogue addressable fire detection systems offer a powerful combination of sophisticated features, simplicity of operation and ease of installation. While some of the advanced features of these fire detection systems have been designed with larger buildings in mind, the benefits of shorter installation time and lower wiring costs are expected to make the systems attractive for even quite small establishments.

Peter Cook is product marketing manager at Cooper Lighting and Security, with responsibility for product development and marketing of the company’s Menvier and JSB ranges of fire detection systems and emergency lighting. He has over 20 years’ experience with the company, having originally joined Menvier to work on its range of central battery systems for emergency lighting. Since the 1997 acquisition of Menvier by Cooper Industries Inc., his range of responsibilities has expanded to cover fire systems.

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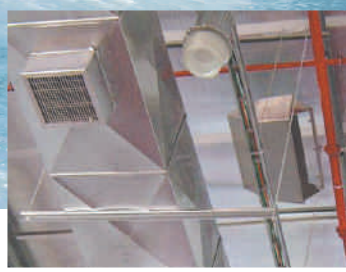

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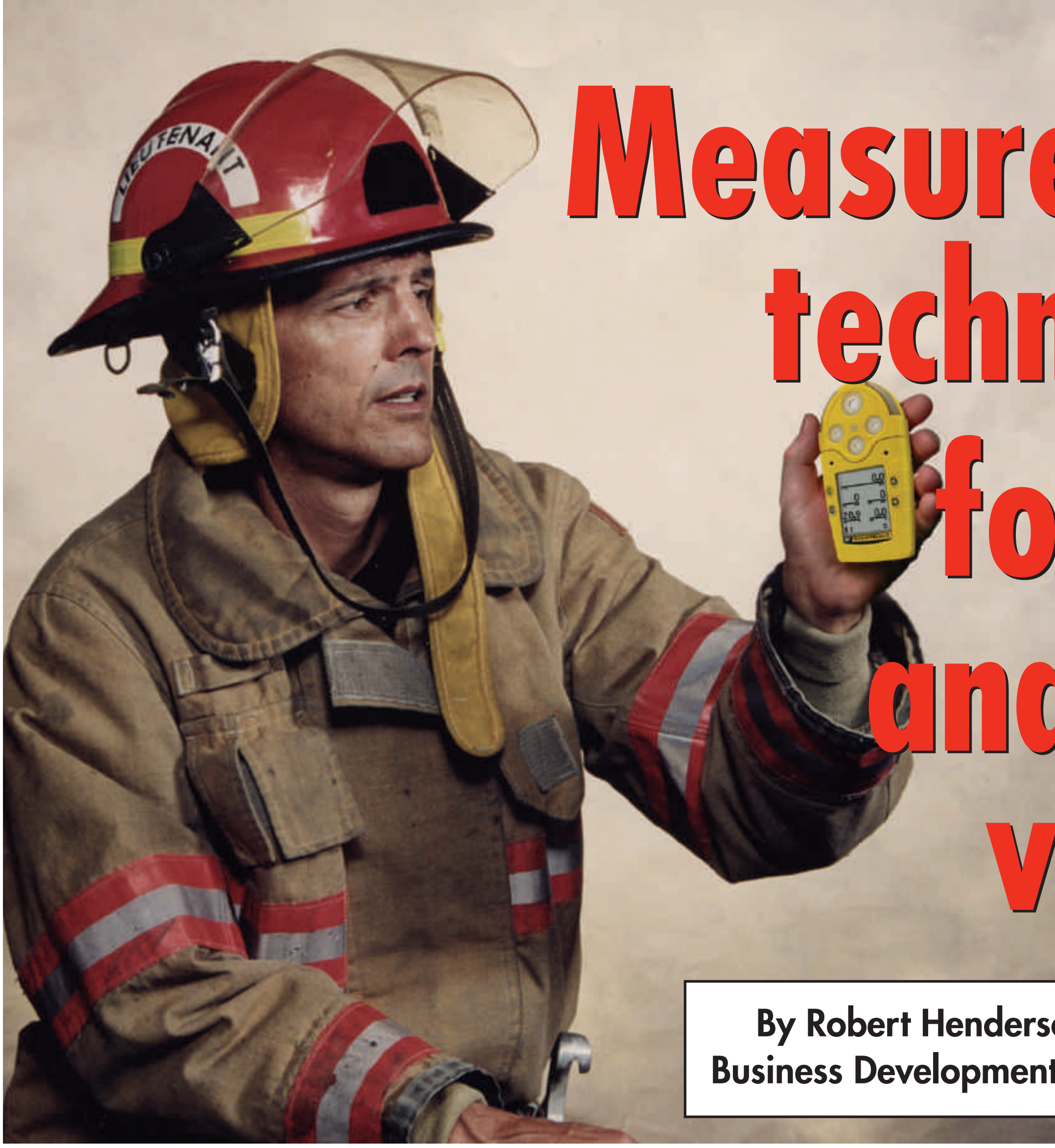


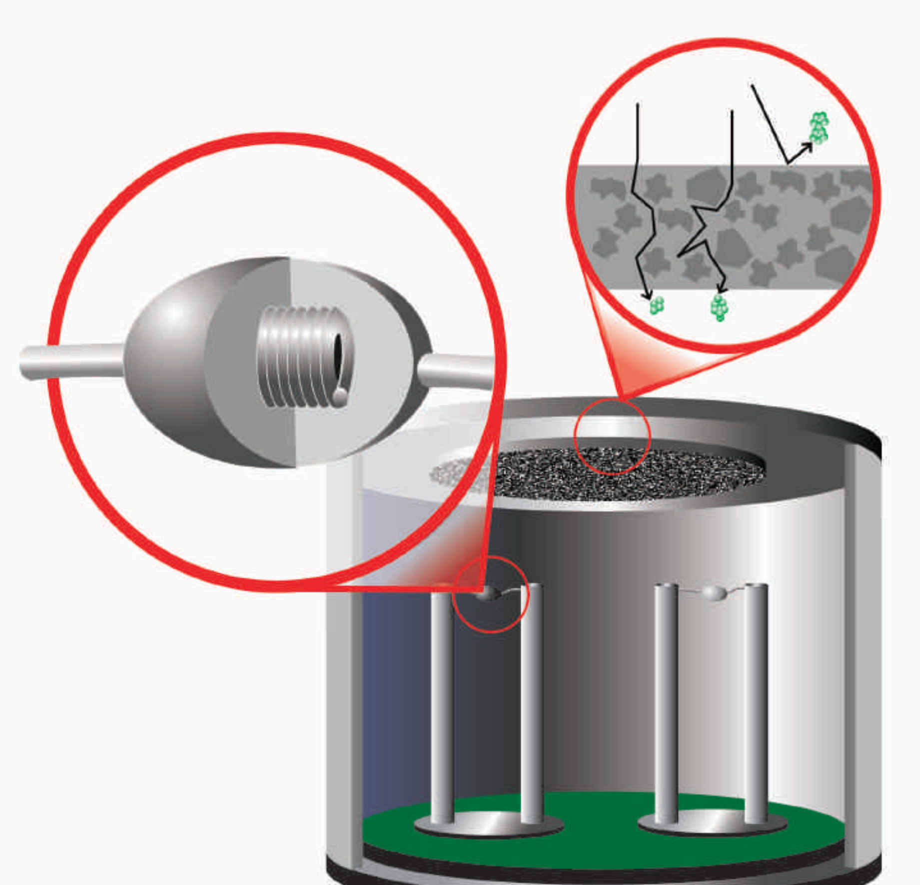
By Robert Henderson, Vice President, Business Development for BW Technologies

Pic courtesy of BW Technologies

VOLATILE ORGANIC COMPOUNDS (VOCs) are organic compounds characterized by their tendency to evaporate easily at room temperature. The presence of solvent, fuel and other volatile organic contaminant (VOC) vapors is a pervasively common part of many Fire Service response scenarios. Familiar substances containing VOCs include solvents, paint thinner and nail polish remover, as well as the vapors associated with fuels such as gasoline, diesel, heating oil, kerosene and jet fuel. The category also includes many specific toxic substances such as benzene, butadiene, hexane, toluene, xylene, and many others. Increased awareness of the toxicity of these common contaminants has led to lowered exposure limits, and increased requirements for direct measurement of these substances at their exposure limit concentrations. Photoionization detector equipped instruments are increasingly being used as the detection technique of choice in these applications.

VOCs present multiple potential threats for Fire Service personnel. Many VOC vapors are heavier than air, and can act to displace the atmosphere in an enclosed environment or confined space. Responding to fuel spills is one of the most common of all Fire Service HAZMAT responses. Because most VOCs produce flammable vapors, in the past, most Fire Service responders have tried to measure them by means of combustible gas measuring instruments. Combustible gas reading instruments usually provide readings in percent LEL increments, where 100% LEL indicates a fully ignitable concentration of gas. Combustible gas instrument alarms are usually set to go off if the concentration exceeds 5% or 10% LEL. Unfortunately, most VOC vapors are also toxic, with permissible exposure limits much lower than the 5% or 10% LEL hazardous condition threshold for combustible gas. The toxic exposure limits are exceeded long before the LEL alarm concentration is reached.

Toxic substances tend to produce symptoms in two time frames: acute and chronic. While some VOCs are acutely toxic at low concentrations, most are chronically toxic, with symptoms that may not become fully manifest for years. Inhalation can cause respiratory tract irritation (acute or chronic) as well as effects on the nervous system such as dizziness, headaches and other long-term neurological symptoms including diminished cognition, memory, reaction time, hand-eye and foot-eye coordination, balance and gait disturbances, tremors, and diminished fine and gross motor movements. Exposure can also lead to mood disorders, with depression, irritability, and fatigue being common symptoms. VOCs have also been implicated in kidney damage and immunological problems, including increased cancer rates. Benzene, a notoriously toxic VOC found in gasoline, diesel, jet fuel and other chemical products, has been linked to chemically induced leukemia, aplastic anemia and multiple myeloma (a cancer of the lymphatic system). There is good reason that the permissible exposure limits for



Pic courtesy of BW Technologies

VOC vapors are as low as they are. Unfortunately, because of the chronic or long-term nature of the physiological effects of exposure, the tendency in the past has been to overlook their potential presence in the workplace environment at toxic exposure limit concentrations.

REAL-TIME MEASUREMENT TECHNIQUES FOR VOC VAPORS

Volatile organic contaminants (VOCs) are generally measured by means of broad-range sensors. Broad-range sensors provide an overall reading for a general class or group of chemically related contaminants. They cannot distinguish between the different contaminants they are able to detect. They provide a single aggregate reading for all of the detectable substances present at any moment.

The most widely used technique for the measurement of combustible gases and volatile organic contaminants continues to be use of a hot-bead pellistor type combustible gas sensor. Pellistor sensors detect gas by oxidizing the gas on an active bead located within the sensor. Most combustible gas reading instruments display readings in % LEL increments, with a full range of 0 – 100% LEL. Typically these sensors are used to provide a hazardous condition threshold alarm set to 5% or 10% of the LEL concentration of the gases or vapors being measured. Readings are usually displayed in increments of +1% LEL. Pellistor combustible gas sensors are unable to differentiate between different combustible gases.

Pellistor sensors that display readings in +1.0% LEL increments are excellent for gases and vapors that are primarily or only of interest from the standpoint of their flammability. Many combustible gases, such as methane, do not have a permissible exposure limit. For these gases using a sensor that expresses readings in percent LEL increments is an excellent approach. Although VOC vapors may measurable by means of a hot-bead sensor, they usually have a toxic exposure limit that requires taking action at a much lower concentration.

Hexane provides a good example. Most exposure limits, such as the American Conference of Governmental Hygienists (ACGIH®) Threshold Limit Value (TLV®) and the United States National Institute of Permissible Safety and Health (NIOSH) Recommended Exposure Limit (REL) reference an 8-hour Time Weighted Average (TWA) for hexane of 50 PPM.

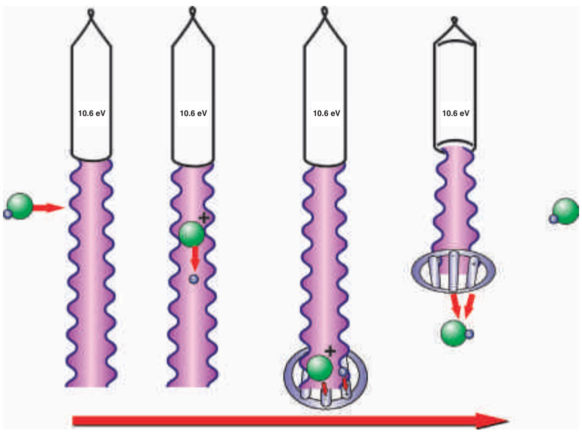
The lower explosive limit (LEL) concentration for hexane is 1.1%. Below 1.1% volume hexane the concentration of hexane vapor to air is too low to form an ignitable mixture. Assuming the combustible sensor alarm is set at 10% LEL, with a properly calibrated combustible gas reading instrument, it would take a concentration of 1,100 PPM volume hexane to trigger an alarm. Even if instruments are set to alarm at 5% LEL, it still would still require a concentration of 550 PPM to trigger the alarm.

Using a combustible gas monitor to measure VOCs presents a number of other potential problems. To begin with, most combustible sensors have poor sensitivity to the large molecules found in found in fuels, solvents and other VOCs, with flashpoint temperatures higher than 100°F (38°C). But even when the span sensitivity of a properly calibrated instrument has been increased sufficiently to make up for the inherently lower sensitivity, an instrument that provides readings incremented in 1.0% LEL steps cannot resolve changes in concentration smaller than ±1.0% of the LEL concentration of the substance being measured. Because percent LEL detectors are poor indicators for the presence of many VOCs, lack of a reading is not necessarily proof of the absence of hazard.

Reliance on hot-bead type LEL sensors for measurement of VOC vapors means in many cases that the OSHA Permissible Exposure Limit (PEL), NIOSH Recommended Exposure Limit (REL) or American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV®) is exceeded long before the concentration of vapor is sufficient to trigger the combustible hazardous condition threshold alarm. When toxic VOCs are potentially present it is necessary to use additional or different detection techniques that are better suited for direct measurement of VOCs at PPM toxic exposure limit concentrations.

It is important to note that although catalytic-bead sensors may have limitations with concern to the measurement of toxic VOCs at exposure limit concentrations, they are by far the most widely used and dependable method for measuring methane and other combustible gases and vapors with smaller, lighter molecules.

Increasing concern with the toxicity of



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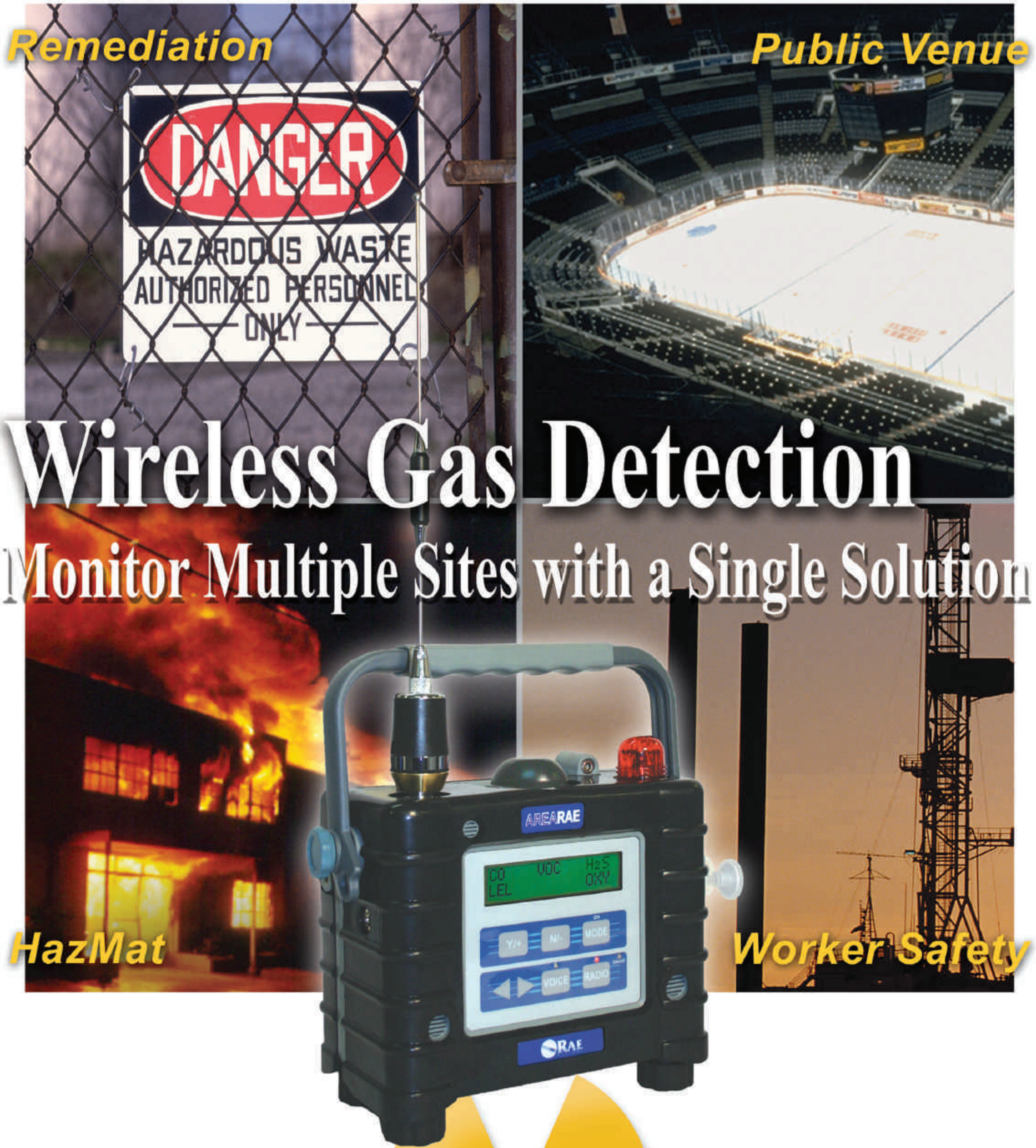

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Exposure Limits and Physical Constants for Ten Common VOCs

Contaminant	LEL Concentration (Vol %)	Flashpoint Temp (°F)	OSHA PEL	NIOSH REL	TLV	5% LEL expressed in PPM
Acetone	2.5%	–4°F (– 20° C)	1,000 PPM TWA	250 PPM TWA	500 PPM TWA; 750 PPM STEL	1250 PPM
Diesel (No.2) vapor	0.6%	125°F (52°C)	None Listed	None Listed	15 PPM	300 PPM
Gasoline	1.3%	–50°F (– 38°C)	None Listed	None Listed	300 PPM TWA; 500 PPM STEL	650 PPM
Hexane	1.1%	–7°F (– 22°C)	500 PPM TWA	50 PPM TWA	50 PPM TWA	550 PPM
Isopropyl alcohol	2.0%	53°F (12°C)	400 PPM TWA	400 PPM TWA; 500 PPM STEL	200 PPM TWA; 400 PPM STEL	1000 PPM
Kerosene/ Jet Fuels	0.7%	100 –162°F (38 – 72°C)	None Listed	100 mg/M^3 TWA (approx. 14.4 PPM)	200 mg/M^3 TWA (approx. 29 PPM)	350 PPM
MEK	1.4%	16°F (– 9°C)	200 PPM TWA	200 PPM TWA; 300 PPM STEL	200 PPM TWA; 300 PPM STEL	700 PPM
Styrene	0.9%	88°F (31°C)	100 PPM TWA; 200 PPM Ceiling; 600 PPM maximum peak above Ceiling for 5 min in any 3-hrs	50 PPM TWA; 100 PPM STEL	20 PPM TWA; 40 PPM STEL	450 PPM
Toluene	1.1	40°F (4°C)	200 PPM TWA, 300 PPM Ceiling, 500 PPM maximum peak above Ceiling for 10 min per 8-hr shift	100 PPM TWA; 150 PPM STEL	50 PPM TWA	550 PPM
Turpentine	0.8	95°F (35°C)	100 PPM TWA	100 PPM TWA	20 PPM TWA	400 PPM

VOCs has led to a number of newly revised exposure limits, including the TLVs® for diesel vapor, kerosene and gasoline. Because the safety procedures for many international corporations are tied to the most conservative published standard, these new TLVs® have been receiving a lot of attention around the world. The TLV® for diesel vapor adopted in 2002 has proven to be particularly problematic, and has led to the revision of numerous oil industry, maritime, and military health and safety monitoring programs. The ACGIH TLV® specifies an 8-hour TWA for total diesel hydrocarbons (vapor and aerosol) of 100 mg/m3. This is equivalent to approximately 15 parts-per-million diesel vapor. For diesel vapor, 1.0% LEL is equivalent to 60 PPM. Even if the instrument is properly calibrated for the detection of diesel – which is not possible for many designs – a reading of only 1.0% LEL would exceed the TLV® for diesel by 600 percent!

The table above lists ten common VOCs, their LEL concentration, flashpoint temperature, and their exposure limits per the OSHA PEL, NIOSH REL and ACGIH TLV®. The table also identifies those contaminants (highlighted) with toxic exposure limits lower than 5% LEL.

What is most striking about the list is how few VOCs have 8-hour TWA exposure limits higher than 5% LEL. None of the VOCs on the list have exposure limits higher than 10% LEL.

USING PHOTOIONIZATION DETECTORS TO MEASURE VOCS

Photoionization detectors use high-energy ultraviolet light from a lamp housed within the detector as a source of energy used to remove an electron from neutrally charged VOC molecules, producing a flow of electrical current proportional to the concentration of contaminant.

The amount of energy needed to remove an electron from the target molecule is called the ionization potential (IP) for that substance. The larger the molecule, or the more double or triple bonds the molecule contains, the lower the IP. Thus, in general, the larger the molecule, the easier it is to detect! This is exactly the opposite of the performance characteristics of the catalytic hot-bead type combustible sensor. Photoionization detectors are easily able to provide readings at or below the PEL or TLV® for all of the VOCs listed in the table, including diesel.

MULTI-SENSOR DETECTORS WITH PIDS

Catalytic hot-bead combustible sensors and photoionization detectors represent complementary, not competing detection techniques. Catalytic hot-bead sensors are excellent for the measurement of methane, propane, and other common combustible gases that are not detectable by means of a PID. On the other hand, PIDs can detect large VOC and hydrocarbon molecules that are effectively undetectable by hot-bead sensors, even when they are operable in PPM measurement ranges.

The best approach to VOC measurement in many cases is to use a multi-sensor instrument capable of measuring all the atmospheric hazards that may be potentially present. Having a single instrument equipped with multiple sensors means no condition is accidentally overlooked.

Robert Henderson is Vice President, Business Development for BW Technologies. Mr Henderson has been a member of the American Industrial Hygiene Association since 1992. He is a current member of the AIHA Gas and Vapour Detection Systems Technical Committee. He is also a current member and past chair of the AIHA Confined Spaces Committee. He is also a past chair of the Instrument Products Group of the Industrial Safety Equipment Association.


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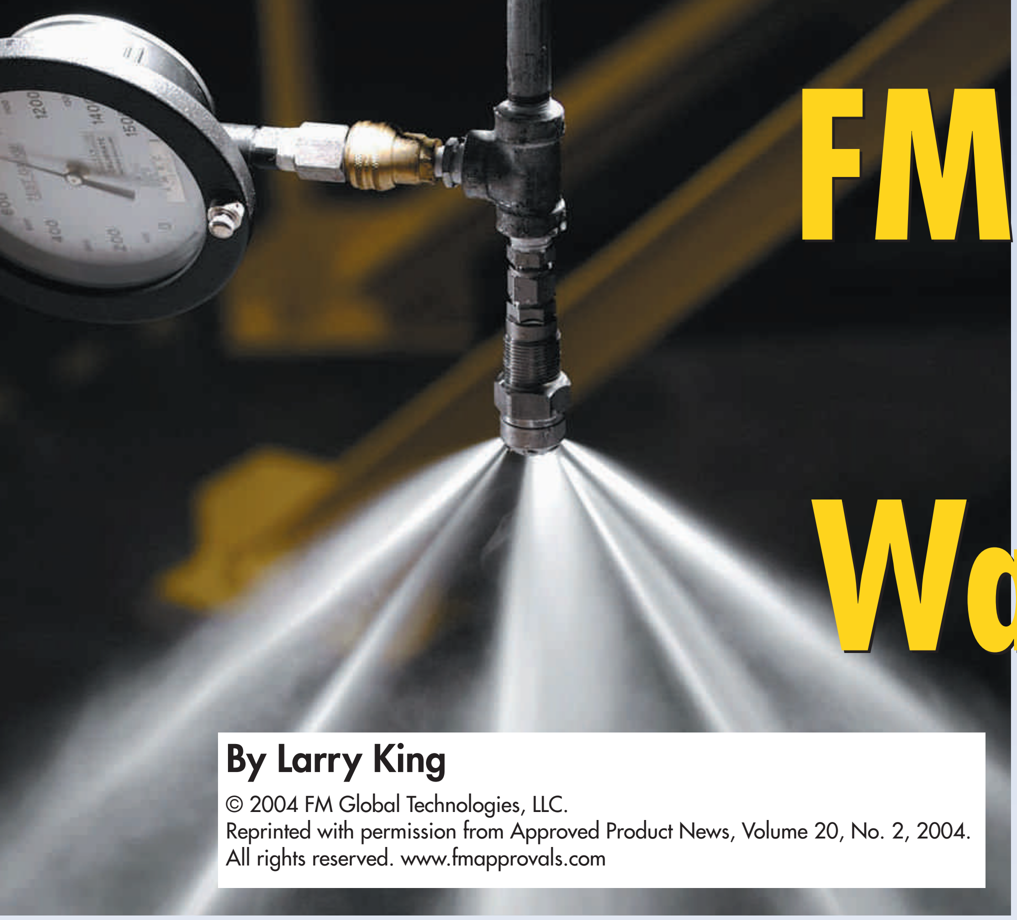

By Larry King

Pic courtesy of FM Global Technologies, LLC

MORE THAN 10 YEARS in the making, the soon-to-be-released "Approval Standard for Water-Mist Systems" (5560) is big, not only in size, but also in its potential impact on an industry that's still in its infancy. Although water-mist fire extinguishing systems have been in use for decades on ships and in other specialized applications, true commercial interest didn't take off until the 1993 ban on halon gas extinguishing agents made water mist a viable alternative.

Why is this standard so extensive? FM Approvals Hydraulics Group Manager Roger Allard explained that, because water-mist systems are so new and each water-mist system is so unique in its operation and design, Approval is limited for now to specific occupancies and applications that have been tested by FM Approvals. For this reason, the new standard must describe fire testing for each of these occupancies and applications, as well as tests for the components that comprise these systems.

A LIVING DOCUMENT

"This new, comprehensive water-mist standard is really a starting point," Allard said. "As we continue to test products, conduct fundamental research and filter all this through our actual field experience, we will refine and expand this standard over the coming years. This is truly a living document." Below is a list of the specific applications and occupancies covered under the new standard and described in appendices to the standard.

A. Machinery spaces with volumes up to, and including, 2,825 ft^3 (80 m^3) – this includes rooms with machinery such as oil pumps, oil tanks, fuel filters, generators, gear boxes, drive shafts, lubrication skids, electrical transformer vaults, diesel engine-driven generators and other similar equipment

B. Special hazard machinery spaces with volumes up to, and including, 2,825 ft^3 (80 m^3) – this includes rooms with machinery such as internal combustion engines, other equipment using fuel and/or lubrication fluids with volatilities less than n-heptane, and incidental use, or storage, of limited quantities of flammable liquid of not more than one or two 55 gal. (208 L) drums

C. Combustion turbine enclosures with volumes up to, and including, 2,825 ft^3 (80 m^3)

D. Protection of machinery spaces with volumes up to, and including, 9,175 ft^3 (260 m^3) (See additional description in item A.)

E. Special hazard machinery spaces with volumes up to, and including, 9,175 ft^3 (260 m^3) (See additional description in item B.)

F. Combustion turbine enclosures with volumes up to, and including, 9,175 ft^3 (260 m^3)

G. Machinery spaces and special hazard machinery spaces with volumes exceeding 9,175 ft^3 (260 m^3) (See additional description in items A and B.)

H. Combustion turbine enclosures with volumes exceeding 9,175 ft^3 (260 m^3)

I. Light-hazard occupancies – typical light-hazard occupancies include non-storage and nonmanufacturing areas such as residential, offices, meeting rooms, hotels, museums (exhibit areas), restaurant seating areas, institutions and schools

J. Wet benches and other similar processing equipment – this application includes tools that consist of ventilated and unventilated compartments, spin-rinse dryers, alcohol-vapor dryers, chemical mechanical-polishing tools and step-and-repeat exposure systems

K. Local application occupancies – typical occupancies within the scope of this section are defined in FM Global *Property Loss Prevention Data Sheets*, No. 7 Series, and are limited to extinguishing fires involving flammable liquid

als Readies mpassing t Standard

Pic courtesy of FM Global Technologies, LLC

L. Industrial oil cookers – industrial oil cookers normally having large cooking surfaces, from 50 ft^2 (4.7 m^2) to several hundred square feet (nearly 30 square meters). They contain from a few hundred gallons (a thousand-plus liters) to approximately 5,000 gal. (18,927 L) of cooking oil, such as canola, corn, cottonseed, peanut or soybean (soya)

M. Other occupancies – manufacturers interested in pursuing water-mist system protection of other occupancies are invited to make such requests, in writing, and provide a detailed description of the desired occupancy and proposed fire protection water-mist system The new water-mist standard also includes extensive information on performance requirements for almost every type of water-mist system component. This section is intended as a guideline for manufacturers to help them anticipate the type of Approval test program they can expect. Some of the component performance requirements covered under the standard include those for:

- Automatic releases
- Ball valve (manual and pneumatic actuation)
- Check and shuttle valves
- Connection block assembly – manifold
- Control panel
- Cylinder burst disks – sealing membrane – rupture disks
- Cylinder, gas storage (Assumption: DOT 3AA-1800)
- Cylinder valve assembly with solenoid actuator
- Detection devices (fire and smoke)
- Drain/fill valve
- Fittings and piping (including couplings and tubing)
- Flow switches (pressure-actuated)
- Foam equipment (foam, injector, proportioner, pumps, valves, etc.)
- High-pressure flexible hose
- Injectors (gas or liquid)
- Level switch (water)
- Manual pull station
- Mounting bracket – cylinder
- Pneumatic-actuated plastic valves
- Pneumatic actuator
- Pneumatic valve assembly (valve, solenoid and pressure switch)
- Pressure gauges
- Pressure-reducing station
- Pressure-relief devices (gas and water) (includes dump, pressure control, pressure-reducing, pressure-regulating, pressurerestricting, relief, safety-relief and unloader valves)
- Pressure switches
- Site glass
- Solenoid valves
- Suction filters/strainers
- Water-mist nozzles
- Water-mist system pumps
- Water (extinguishing fluid) storage tanks
- Water valves (control)

GOOD REASONS TO GET MISTY

Approval Standard 5560 will provide the most comprehensive single source of water-mist test requirements in the world for land-based applications. Manufacturers of water-mist systems and components will be able to quickly find fire and component test requirements. This will save both time and money by reducing errors and helping manufacturers to more accurately anticipate the test program required for Approval.

"Before this standard, when a manufacturer came to us with a new water-mist fire protection system, our engineers would have to search out test standards for each component and design custom fire tests for the overall system," said Rich Ferron, technical team manager in the FM Approvals materials group (and former point person for water-mist system testing). "This new, comprehensive standard cuts preparation time for testing proposals in half and, more importantly, reduces the overall cost of testing. This means faster time-to-market for manufacturers and less frustration for both manufacturers and FM Approvals."

According to Ferron, the new standard also promises to help FM

FM Approvals Readies All-Encompassing Water-Mist Standard

Pic courtesy of FM Global Technologies, LLC

Approvals find answers for manufacturers faster and more accurately by providing a single source for water-mist information. Ferron, who has served on the watermist technical advisory group of the International Organization for Standards (ISO), said he hopes the new Approval Standard is adopted or used as a springboard for international water-mist standards for land-based applications.

"ISO has said to us, 'You produce a standard and we'll consider it,'" Ferron said. "Now, we have something to lay on the table. Until now, most organizations have only concerned themselves with watermist nozzles. We know there's much more to these systems than just a nozzle. You have to look at the whole system because they can be very complicated with many interdependencies."

WHY WATER MIST?

Water-mist fire protection systems offer some unique benefits that make them particularly well suited for challenging environments. For instance, water-mist systems not only can suppress or extinguish fires, but they also can have a cooling effect within the protected space that makes it easier for firefighters and others to enter and extinguish the fire. Water-mist systems also use far less water than conventional sprinklers, a tremendous advantage where contaminant runoff is a concern or runoff collection is mandated. Other advantages include:

> *Water-mist systems not only can suppress or extinguish fires, but they also can have a cooling effect within the protected space that makes it easier for firefighters and others to enter and extinguish the fire.*

- **Prevents re-ignition.** Because of its cooling effect and room-flooding ability, water-mist systems are very good at preventing re-ignition, even from oil-bath fires and other pool fires.
- **Works well in high-heat-release fires in enclosures when total "flooding" protection is used.** As an enclosure is flooded with water mist, the atomized droplets are drawn to the base of the fire along with room air. The water mist instantly flashes to steam, expanding in volume by about 1,700 fold, replacing the oxygen necessary for combustion.
- **Works in partially ventilated areas.** Unlike CO_2 or halon, water mist works in areas where a door or vent has been left open and does not pose a health risk like some other gaseous agents.
- **Smoke-scrubbing qualities.** Some smoke and toxic gases are absorbed by the atomized water spray.

"This standard, perhaps more than any other we have produced, required the close working relationship of our engineering and research division," said Hydraulics Group Technical Team Manager Dave Fuller. "Clients asked FM Global engineers for alternatives to traditional gaseous agent systems and manufacturers were coming to FM Approvals with new water-mist systems. When we didn't have the answer, we went to research for their help. Bert Yu and others in research have led the industry in water-mist research and groundbreaking innovations, and are working to understand the fundamental mechanisms of water mist so we can move away from trial-and-error test methods."

The new FM Approvals water-mist standard will be distributed for review to selected industry and internal reviewers this summer. Once this feedback has been incorporated into the draft document, the final standard will be released in late summer or early fall.

To learn more about the new water-mist Approval Standard, contact Larry King, senior engineer, hydraulics group, at +1 (1)401 567 0590, ext. 5441, or e-mail him at lawrence.king@fmglobal.com

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Escape Chu High Rise

Pic courtesy of Escape Consult Mobiltex

EVER SINCE THE WORLD TRADE CENTER towers collapsed so quickly and unexpectedly on September 11, 2001 that many people had no time to escape, safety officials and engineers have been trying to think of efficient escape systems to get people out of very tall buildings more quickly. An emergency escape chute is just one of the answers.

The use of escape chute system may be new or unfamiliar in some countries, but the concept of escape chute was developed hundred years ago. Since then, with the advancement in technology and innovation, different variations of escape chute are being developed worldwide with intended performance to take people out of burning high-rise structures during life threatening emergencies. The use of escape chute is a potential means of life saving during emergency egress for those with difficulties or has no ability to use stairs.

Currently, there is no standard for the design and construction of escape chutes in meeting specific performance requirements. The lack of knowledge present extraordinary challenges for the first-time buyers – what to assess in the strengths and weaknesses of the intended performance of the chute they plan to buy. The purpose of this article hopes to provide some basic information necessary for building safety professionals, owners and management of buildings to be aware of when source for escape chutes and its suitability of use for their building exit strategies.

FREQUENTLY ASKED QUESTIONS

Currently, there are no Codes requiring buildings to provide escape chutes for aiding evacuation, nor Standards developing bodies that have come up with standards to address the performance of escape chutes. If current fire regulations do not require buildings to provide escape chutes to aid rescue or evacuation purposes, should it be used? Would a life saving chute need to be constructed with fire resistant materials to protect the users from the fire effects once inside the tube? Should it be designed to safeguard those who are most vulnerable in an emergency: children, the elderly, the injured, and the disabled to use the chute during evacuation? Should the chute be designed to allow the users to have the ability to self-control the speed of own descends? Should it also be designed to allow external means to control the speed of one's descend from the outside? Should it be manufactured in conformance to its performance as "escape chute" tested by a fire research institute? How should the platform and the storage of chute be designed and installed? When a chute is installed in a fixed and permanent location whereby building occupants recognized that it is meant for emergency use only, should such egress provision be considered as an emergency exit? Finally, while high-rise occupants are accustomed to the conventional use of elevators/lifts and stairs in gaining access and egress from a tall structure, would people under life threatening situations use the

Currently, there are no Codes requiring buildings to provide escape chutes for aiding evacuation, nor Standards developing bodies that have come up with standards to address the performance of escape chutes.

te For Aiding Evacuation

Pic courtesy of Escape Consult Mobiltex

unfamiliar chutes to get out alive even to the extend in risking injuries?

A study on why escape chutes are not commonly installed in buildings suggests the lack of knowledge of building safety professionals about using such systems as a means of emergency fire escape. Further, there are currently no standards for addressing the performance of escape chutes, nor mandatory requirement for placing them in structures for aiding rescue or evacuation purposes.

ALTERNATIVE MEANS OF ESCAPE

While not recognized by Codes, escape chutes are used voluntarily at buildings and at high-hazard industrial occupancies in many countries. They provide possible solutions in an effort to salvage life in extreme emergencies. In many situations, escape chute is recognized by many fire authorities as a hardware solution to correct egress deficiencies and to increase egress capacity in old buildings where it is not possible to provide fire escapes or increase the size of existing stairways in its structure.

While the idea of a chute evacuation may not be something that is very appealing to some people, it has slowly gained popularity. Given the opinion that elevators/lifts are unsafe to use for fire egress, stair travel is taxing and potentially dangerous for the aged and the disabled, evacuation via escape chutes provides the answer to make means of egress available to all people. As the escape chute can be installed at strategic locations and at heights within the structure, will operate even if the electrical supply to a building is lost during a fire, it is intended as a supplement to the existing egress, provide redundancy and back-up as an alternative escape route. The innovative applications in escape chute technologies have enabled designers and architects to have a new way of thinking in egress design to meet performance-based specifications for the provision of evacuation accessible to everyone in the built environment.

THE VARIATIONS AND DIFFERENCES IN SPECIFICATIONS

Escape chute vary in price and in specifications. Chute tube from different manufacturers may look alike in appearance and resemble another chute but the specifications in the constructions are different. Such as, the materials used for the construction of chute components, its descending systems, and its safety features. Chute- and slide-based devices typically use a fabric tube deployed from a location up to 30 stories above the ground and require run-out room to allow evacuees to slow before exiting. Not all escape chutes are tested by the fire research institute for its intended function and performance.

Generally, the differences between the variations of escape chute can be classified as, (1) the compositions of the chute tube, (2) the descending systems, and (3) the chute platforms for holding and storing the escape tube.

1. **Chute Tube:** Some chute tube is made of different layers of fire resistant fabrics, while other is from fire retardant fabrics. Some chute tube is made of large steel coil with fire retardant materials, while other is of heavy-duty nylon tubular net.
2. **Descending Systems:** There are vertical gravity descends type, spiral descends type, and sloping-sliding descends type. Most systems are of free fall type with no or little possibilities of self-controlling descend speed or method to control speed of one's descend. Some chute has a series of stainless steel coiled

Pic courtesy of Escape Consult Mobiltex

Escape Chute For Aiding

Pic courtesy of Escape Consult Mobiltex

springs sewn into the material, intend to restrict the speed of descend. Another system that uses braking coat spuncell in allowing users to self-control his/her own speed of descend and it also allow assistance from the ground to control the user's speed of descent.

3. Chute Platform: All chute platforms should be designed with built-in storage container to protect the chute tube from weather and other effects when unused in storage. The mechanism of the platform should be designed to allow the chute tube to be released from its storage container within seconds from unlocking the safety lever/ catch and ready for immediate use. Each platform should be custom-designed to fit each installation site. The materials used for the construction of the platform are made from aluminium, galvanized steel or, depending on climatic conditions, stainless steel. In principle, all chute platforms should be constructed and installed to specifications that enable them to support people with a total weight of 1000kg regardless of the chute length.

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To illustrate an example, this article examines the specifications of an Escape Chute which is manufactured in conformance to its performance as "escape chute" tested by a 'fire research institute for fire protection' that permit evacuation from high-rise structures during an emergency. This unique chute has a 3-separate layer of specialized materials in its construction of the fire resistant chute tube:

- **Inner Layer:** The inner layer is made up of two materials, Twaron is applied along the length of the chute, and Flexible Rohvyl yarn based on PVC chlorofibre is used across the chute. This hybrid fabric is extremely strong, very flexible and is also of heat resistant. The inner layer bears the load of the total chute, able to withstand approximately 10,000 kilos or a maximum load of 5,600 kilos per metre width of fabric.
- **Middle Layer:** The centered layer is made up of a very elastic 'spun cell' – made of Lycra and Modlacrylic fibres – and can easily increase three times in size. It is this layer, comparable to an elastic knee supporter, which 'hold' the evacuee as soon as the arms and legs is pressed against the chute.
- **Outer Layer:** The outer layer of the chute, made of flexible glass fibre, provides protection against fire, heat, and smoke, and can resist temperatures of up to 800°C. When firemen spray the chute with water, it can even be used at higher temperatures than that.

Because of the specialized materials used in the construction of the chute tube for its unique application, this particular escape chute and its built-in safety features does not come cheap in comparison to the other variations of escape chutes that are available in the market. When the chutes are regularly used for drills, this means they have to

be retrieved, folded out and up a lot after each use. The materials used for the construction of this unique chute are excellently suited for that purpose. The chute bears some resemblance to a giant nylon stocking – just many times longer. It may have a length up to 150 metres, is incredibly strong and also withstand heat of up to 800°C. The evacuees sit on the rim of the escape chute and lower themselves slowly down. Around the evacuee a kind of cocoon is formed, much like a football in a nylon stocking. By pressing the legs tightly against the lining of the chute it becomes possible to stand up straight. As soon as the evacuee is standing up and slowly relaxes both legs, he or she will slide down through the chute. It is not necessary to go down at an awkward pace, because speed of descend can easily be reduced by pressing the arms and legs against the side of the chute. This way, capable of evacuating 30 people a minute, mass evacuations can be realized fast and safely.

APPLICATIONS OF ESCAPE CHUTE

Escape chute is mostly customized for a specific application, for instance, in tall buildings, ferries, grain silos, air-traffic control towers, or giant shovels used in the mining industry. Some installation site may require minor alterations to the fabrics of the structure to accommodate the custom-designed platform for the chute installation. Most chute installations are permanently fixed in one location served as emergency exits.

As buildings vary so significantly in terms of height, size, structure, age, fire protection, occupancy load and how they are used, each installation site for escape chute need to be surveyed, tailoring the solution to each building needs and evacuation strategy. Escape chute should not be sold as "off-the-peg" unless the buyer know where the precise strategic location for the chute to be install in the building.

There are various types of escape chute. Some are stored away in containers, such as the single-entry type mounted on the rooftop, balcony of corridor, and window, allows occupants gain access to the chute on that floor. The multi-entry type allows occupants gain access to the chute at each floor where several levels can be simultaneously evacuated. In addition, there is a mobile version, which can be attached to a sky lift or ladder truck.

Pic courtesy of Escape Consult Mobiltex

KEY CONSIDERATIONS – SPECIFICATIONS AND PERFORMANCE

Safety thinking has radically changed since 9/11 and the demand for escape chute in buildings has also increased. With so many variations of escape chute that are available in the market, the first-time buyers should assess and compare the specifications, the strengths and weaknesses of the intended performance for each system/option and its suitability of use for their building exit strategies. When available, ask for a demo-chute where you can see and slide to feel its performance. For safety's sake no price should be too high in buying the RIGHT escape chute that permits safe evacuation approved by a fire research testing institute for fire protection.

As in all evacuation plans, first responders, building managers and even tenants would need to be trained and drilled in how to use the escape chute system safely to ensure that the last great barrier to access, egress is overcome for all! With frequent practice in drills, evacuee will even feel safer descending down the long chute than negotiating the long flight of stairs during mass evacuation. This way, the evacuation process will be well coordinated and more people can get down rapidly. As in all fire protection equipment and elevators/lifts, the escape chute would need to be maintained periodically to ensure it to be effective in an emergency.

CONCLUSIONS

Currently, there are no codes around the world which permit the use of elevators/lifts in fire egress situations and neither are there codes that require buildings to provide escape chute as a secondary means of emergency egress for all occupants. However, it is evident that escape chute do offer an additional means of egress in instances where an extreme event is imminent and rapid simultaneous evacuation is warranted, especially for those buildings that are not designed for full-scale evacuation. While many believed that escape chute appears to be a viable evacuation technique for various applications, the first-time buyers should ensure the specifications of the escape chute that they intend to buy is designed and constructed to permit safe evacuation in fire situations.

This article is contributed by Escape Consult Mobiltex (S) Pte Ltd. For more information on Ingström Escape Chute, please visit www.escapeconsult.com


In Case of
FIRE
~~BREAK GLASS~~
RELAX

Valve Designs for Flammable Fluids

By Wayne Ulanski

Pic courtesy of OCV Control Valves

IN MANY PROCESSES THROUGHOUT the chemical processing and refining industries, valves and automated valves are required to handle flammable fluids. Valve manufacturers currently offer designs intended for this service called fire-safe valves. Selecting a valve that will provide shutoff in the event of a fire begins with an understanding of the term fire-safe and the standards established by users and independent testing companies.

First to consider is that a valve intended for fail-safe service will probably not be required to perform in the event of a fire for many years-and hopefully never. The valve selected, therefore, should operate as a tight shutoff valve in normal operation before a fire and during and after a fire. A review of the construction features of the various types of fire-safe valves will help in their selection.

According to the MSS, the terms fire safe or fire tested are not definitive and should not be used without an accompanying specification of what is required. Such specification may be provided in the form of a requirement for a defined test or for limitations on valve failure mode. Examples of such limitations are:

1. Destruction of elastomeric materials in the valve shall not result in gross valve pressure-boundary leakage.
2. Destruction of elastomeric materials in the valve shall not result in leakage greater than the specified rate when the valve is closed.
3. External heating of the valve shall not cause uncontrolled buildup of pressure in the body cavity of a double-seated valve.

Requirements related to after-fire operability and seat tightness are difficult to define other than by actual testing using standardized procedures.

Three important criteria for evaluating fire safety in valves, and the major concerns of testing authorities, are external leakage, internal leakage, and operability.

1. Minimal external leakage. The best valve body design minimizes external leakage by eliminating large gasketed body joints and provides an adequate stem sealing arrangement of fire-resistant materials.
2. Minimal internal leakage. For fire-safe sealing integrity, some valve designs provide metal-to-metal seating prior to, during, and after exposure to a fire without relying on complete destruction of the primary resilient sealing member, or any supplementary spring loading or overtravel of the disc or ball to achieve metal-to-metal contact.
3. Continued operability. To be truly fire safe, a valve must be operable even if it is fire-damaged. The best overall design is one that eliminates heat distortion of the valve body and operating mechanism caused by thermal stresses and associated piping stresses during a fire. Some increase in torque should be expected, and so actuators when selected should be sized using an adequate safety factor for worst-case operability.

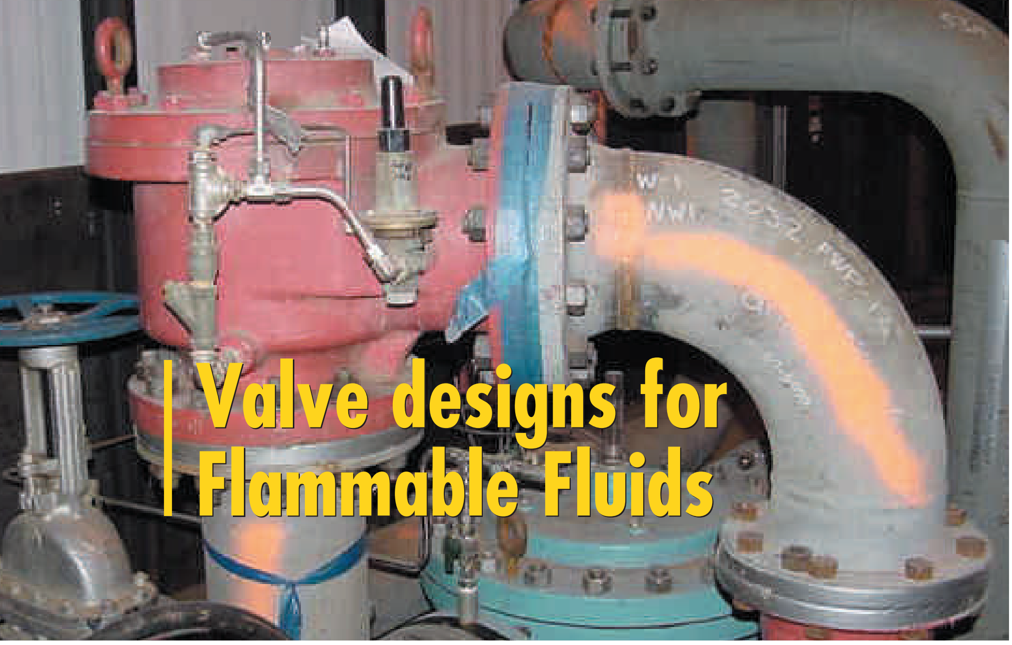
TYPES OF VALVES USED IN FIRE-SAFE SERVICE

Generally speaking, a fire-safe valve is one that will withstand a fire and provide a degree of shutoff that is acceptable under given conditions. Extremely high temperatures necessitate the use of metal construction. For this reason the first types of valves to be considered fire-safe were gate and globe valves because of their metal-to-metal seating. Because of their metal seating these valves leak somewhat in normal operation and will likely leak even more if distorted by a fire.

There are no established test standards to measure the fire-safe capability of gate or globe valves. Today, soft-seated fire-safe valves are preferred because they:

1. Provide tight shutoff in normal operation as well as during and after a fire
2. Are economical
3. Are easier to automate than gate or globe valves
4. Are designed and manufactured to meet established fire-safe valve standards

Current soft-seated rotary valves include ball valves, high-performance butterfly valves, and some plug valves. In providing bubble-tight shutoff in normal operation as well as fire safety, manufacturers of rotary stem valves are utilizing two types of seating arrangements with their valves.



Valve designs for Flammable Fluids

Pic courtesy of OCV Control Valves

The first and most common may be referred to as a two-stage seat. This system relies upon a full burn (or melt) of the resilient seat before metal-to-metal sealing occurs. For a fire-safe ball valve, metal sealing occurs when, for instance, the floating ball moves downstream to contact a machined surface in the body that matches the contour of the ball. If a quickly extinguished fire or other condition prevents full seat burn, however, the floating ball would not be permitted to fully contact the matching downstream metal seat. This could cause excessive internal leakage and defeat the intent of the established testing standards.

A second system typically used by some high-performance butterfly valve manufacturers is not dependent on total seat burn. Here a resilient seat and metal seat contact the disc at the same time. Because there is always contact with the metal seat it will provide an established leakage rate even if the resilient seat is only partially burned.

External leakage presents other problems. The most common leakage occurs past the valve stem once the thrust washer melts and requires a second metal-to-metal seating arrangement. This is usually accomplished by expanding the outer diameter at the stem's base so that it contacts a lip machined into the valve body. In a manually operated valve, this design works if the handle does not prevent the stem from moving vertically. If the valve is actuated automatically, the drive coupling should accommodate this motion. If the valve is of a two-or three-piece body design, attention must be paid to the body seal materials to prevent leakage during a fire. High-performance butterfly valves use a rigid disc and stem connection. The packing material is usually graphite based to withstand high temperatures to 1300ºF (700ºC). The one-piece body design of most high-performance valves eliminates body seal leakage.

DESIGN TESTING AND STANDARDS

Since not all fires are alike, safety precautions should not be the same for all situations. While another industry's standards may be followed when the medium in the piping is the same, it often is unacceptable to do so when different media are involved. Thus, using standards of the oil-refining industry for other segments used in the chemical process industry raises major questions: Do the refining industry's standards cover the fire hazards posed by media and processes specific to the rest of the chemical process industry? Which criteria come closest to providing proper guidelines for choosing a fire-safe valve for non-oil refining service?

With the introduction of resilient valve seat materials [rubber or plastic compositions with melting points under 700ºF (370ºC)], methods of defining and testing the fire safety of soft-seated valves became necessary. In developing a basis for valve design, operating specifications and test procedures, testing houses have first had to specify the fire conditions. Generally, these tests do not duplicate a real fire and so cannot illustrate actual conditions. Because industry experts are unable to agree upon a definition of a standard fire, it is impossible to develop an all-encompassing test for fire-safe valves.

HOW DO TESTING HOUSES DEFINE FIRE?

Quite often users of fire-safe valves work with in-house or independent test committees to define a fire-safe test to meet their needs. Things to consider for fire-safe valve test specifications are:

1. **Valve type (metal to metal, etc.).** These may be divided into (a) seats which have continuous metal-to-metal contact in the closed position and (b) two-stage seats which rely upon some secondary means such as seat or ball overtravel, system pressure, gravity, or spring loading to establish metal-to-metal contact when fire occurs.
2. **Stem position.** This is important in evaluating the severity of a fire test and may be the most important criterion in evaluating a test as to its applicability to the chemical process industry. The thermodynamic properties of the medium, vapor pressure, expansion rate, and toxicity must be considered as well. Certainly, a valve with the stem in the vertical position handling a high-vapor-pressure monomer or solvent presents a different problem than one handling a low-vapor-pressure medium such as a diesel fuel. For practical reasons, the more severe vertical stem position should be specified when selecting or defining a test standard.
3. **Bore position.** For purposes of testing, the bore in the horizontal position is often specified so that the weight of the closure element will not augment the seal. This is particularly true for the floating ball valve.
4. **Valve open or shut.** If the valve is open, the test is more severe. While valves in real plant situations are both open and closed, those that are open will be the more critical if, in a fire, they are closed to isolate sections of the plant. In the open position, the valves' soft seat if unsupported can sag into the flow path. Upon closure, the sagging, partly burned seat can prevent full closure of the valve after the fire.
5. **Test pressure during burn.** Each standards organization has made the pressure requirement low. This assumes that most valves are not used at their highest operating pressures and are installed in systems containing pressure-relief devices. The validity of this approach can only be evaluated from the standpoint of good piping practice and safety.
6. **Test medium.** As a test medium, water is safe to use and its properties are easy to measure. However, with water, it may be difficult to spot a leaking packing or body flange without performing a mass balance. In addition, the thermodynamic properties of water and steam may not simulate the real-life fluid. On the other hand, if the test medium is a hydrocarbon, its viscosity and its flammable nature immediately signal a leak during the test. Although this is more dangerous than testing with water, it certainly represents a more realistic situation.
7. **Burn duration.** The time for a test should be based on the specific type and size of valve. During the specified times, a smaller valve would

experience total soft-seat destruction. However, a larger one may show only partial destruction. Partial soft-seat destruction is more realistic during a fire and is a more stringent leakage-test requirement. To accurately and fairly evaluate a fire-safe valve, both partial and total soft-seat destruction should be tested for. The test would encompass the use of a specific time and two temperatures.

8. **Time when seat leakage is measured.** In the Factory Mutual (FM) and American Petroleum Institute (API) tests, seat leakage is measured during and after the fire. Both tests are performed in the closed position. In the Exxon test, the seats are open during the burn. Therefore the leakage can only be measured after the fire.
9. **Allowable leakage and maximum external leakage.** For the CPI, this is a critical factor, considering toxic leaks, environmental issues, and the like.
10. **Maximum seat leakage.** The significance of these leakages can be seen when they are compared with the standards used for valve manufacturers. MSS-SP 61 and API 598 specify 10 cubic centimeters per hour (cm^3/h) and 12 to 20 drops per minute (0.75 to 1.75 cm^3/min), respectively, for new valves.
11. **Operability.** The Oil Companies Material Association (OCMA) test, which requires the valve to open and shut for three cycles when hot, is done within 15 mm of the fire test. The valve not only has to be cycled while it is hot but before the leakage testing is done. API requires the valve to be cycled only once after the seat test, therefore not requiring the reseating of the valve. (The testing is done in the closed position.)

Even with their differences, existing tests provide a good general indication of whether a valve is fire safe. For the CPI, users may wish to combine or modify established independent tests to best meet their own needs. Clearly, in setting a standard, one fact should be a primary concern: During a fire, a fire-safe valve will go from having a complete seat to a partially or totally destroyed one. Most industrial fires are quenched long before valve seats are totally destroyed. A partial burn test is the best indicator of how a valve will act during a fire.

TESTING CRITERIA AND METHODS

It is impossible to have a single definition of a fire. Certainly the type of fire that may occur in a refinery is different than that in a chemical plant. For example, some fires burn longer or hotter and some spread faster.

The four standards used to establish fire-safe valve performance conditions are:

- **API**: American Petroleum Institute
- **BS**: British Standard (formerly the Oil Companies Materials Association [OCMA])
- **Exxon**: Independent Refinery Standards
- **FM**: Factory Mutual Research

These standards reflect what is perceived by each to be important test criteria for the valve sizes and types used in their industry. The difference in flow media, fuel, fire duration, pipe size, and valve orientations, as well as measurement techniques and the amount of leakage deemed acceptable, may be different, but the goal of each test is the same: to establish a minimum safety standard for valves in flammable liquid service.

What is a fire? Before design and performance standards for fire-safe valves are developed, a fire must first be defined by using the following criteria: the fire test medium, the temperature at the valve body, and the duration of the fire. The Factory Mutual Research Corporation requires 15 mm of exposure to a flame temperature range from 1400 to 1650°F (760 to 900°C) for the duration of the test. This is considered the heat that is typical of spill fires that might be experienced in a chemical processing plant. To simulate such a fire the test equipment includes a pan of liquid heptane 10 ft^2 (3050 mm^2) in size. The manual or automated valve being tested sits 18 in (460 mm) above the liquid surface for the duration of the burn.

To complete the prefire testing process, the valve must also undergo a cycling test. The valve design and construction must be able to permit reliable operation through 5000 cycles under specified conditions.

After the valve meets normal operating expectations, it is fire-tested. Test equipment includes a pan of liquid heptane 10 ft^2 (3050 mm^2) in size, condenser, safety valve, and measuring device such as a graduated cylinder. Approximately 18 gal (68 L) of heptane, enough to feed a 15-mm conflagration, are placed in the pan. The valve, which remains closed throughout the test, sits 18 in (460 mm) above the liquid surface. Its orientation is normal: vertical stem, horizontal bore. Water serves as the flow medium.

During fire testing, the flow media cools only the high-pressure side of the valve; the downstream side suffers the fire's full effect. It takes about 5 mm to heat the valve to 700°F (370°C), the temperature at which the soft seat material melts or burns away, triggering the backup seat arrangement. After 15 mm, the pan fire is extinguished and the graduated cylinder is removed to measure leakage. The condenser, located down-

Pic courtesy of OCV Control Valves

stream of the valve, cools any vapors that might have escaped to keep the reading accurate. The test concludes by spraying the valve with 1¼ in (32-mm) hose for 1 mm.

Anything less than 0.057 in^3/min (0.95 mL/min) past the valve seat, regardless of pipe size, is acceptable. External leakage around the stem or flanged fittings is limited to individual drops. The requirements also apply to ordinary valves. If they fail to meet the requirements, testing is suspended temporarily. The manufacturer may then withdraw the unit or implement the design changes needed to meet the requirements.

FIRE-SAFE VALVE SPECIFICATIONS SUMMARIZED

Regardless of safeguards taken during the design process, a valve design should not be considered fire safe until it has been tested under fire conditions. Standards such as those sponsored by the API, BS, Exxon, and Factory Mutual Research are all comparable. For valves to be approved by a third party; the valve manufacturer must meet certain quality standards during manufacture. A site visit is usually conducted to establish the control conditions under which the valve is produced, and to determine the manufacturer's commitment to product quality.

In a multimillion-dollar chemical process, valves play a role disproportionate to their size and cost. These small, relatively inexpensive parts are critical to the safe performance of the process. Since valves are often the first line of control for flammable liquids, it is extremely important to install only valves that are fire safe. This one preventive act can help save hundreds of thousands of dollars and hinder costly business interruptions.

Considerations when specifying and installing beam smoke detectors

By Steve Scorfield
Technology Manager
System Sensor Europe

Typical beam application

BEAM SMOKE DETECTORS ARE the obvious choice for protecting buildings with high ceiling areas such as atriums, lobbies, gymnasia, sports arenas, museums, churches, factories and warehouses. Typically, fires will start at the lower elevations of the property, at or near the floor level. When this is the case, the smoke produced by the fire will rise to the ceiling; the column of smoke begins to spread out as it travels from its point of origin, forming a smoke field in the shape of an inverted cone, becoming more dilute as it rises. As a result of the drop in smoke density, point detectors tend to become less effective the higher they are mounted. BS5839 part 1 thus limits the mounting height of point detectors for life protection to 10.5m, or 15m for property protection.

On the other hand, beam smoke detectors, which sample across the entire smoke plume, are ideally suited for high ceiling applications. This is reflected in BS5839 part 1, which permits the use of beam detectors up to heights of 25m for life protection and 40m for property protection.

BEAM DETECTOR TYPES

European approved beam smoke detectors are tested to EN54-12: 2002 Fire Detection and Fire Alarm Systems – Smoke Detectors – Line Detectors using an optical light beam.

There are two basic types of projected light beam detectors, End-to-End or reflective, both of which operate on the principle of light obscuration: a light beam is projected across the area to be protected, and is monitored for obscuration due to smoke. The End-to-End detector has separate transmitter and receiver units mounted at either end of the area to be protected. End-to End detectors require power to be supplied both to the transmitter and the receiver, leading to longer wiring runs, and thus greater installation costs than the reflective type device. Reflective or Single-Ended detectors have all the electronics mounted in the same housing: the beam is transmitted towards a reflector mounted at the far end of the area to be protected, and the receiver monitors the attenuation of the returned signal.

Although reflective detectors are now more commonly used than End-to-End devices due to the substantial saving in installation costs, certain considerations need to be taken into account when they are used. It is important to understand that in the case of an End-to-End beam detector any object placed in the way of the beam that will decrease the signal strength of the beam will not compromise the operation of the beam detector, the worst that can happen is that a false alarm can be given. With a reflective beam detector, a reflective object placed in the beam's path, particularly if close to the unit, may cause sufficient reflection back to the receiver even though the signal to most of the detection area is blocked. This is likely to be more of a problem for beam detectors with low amounts of reflection, usually small reflector types.

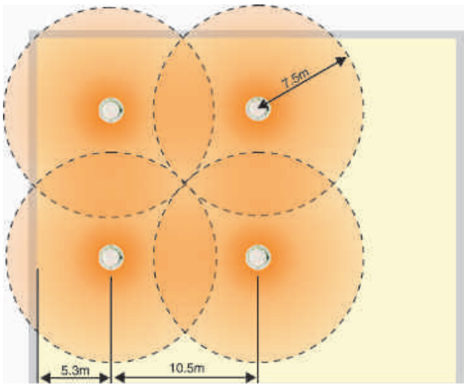


Figure 1a: maximum area coverage for point detectors

RELATIVE COST

According to BS5839 part 1, a point smoke detector has a maximum radius of coverage of 7.5m. For a simple spacing plan, *figure 1a*, this translates to a maximum distance between detectors of 10.5m. Careful manipulation of the detector layout, *figure 1b*, can reduce the number of point detectors required to cover a given area. For beam smoke detectors, BS5839 part 1 allows a maximum range of 100m, and coverage of 7.5m either side of the beam, giving theoretical area coverage of 1500m^2, *figure 1c*, an area which normally would require sixteen or more point smoke detectors to cover. Reducing the number of devices used will lower installation and maintenance costs. The major limitation of the projected beam smoke detector is that it is a line-of-sight device and consequently subject to interference from any object or person, which may enter the beam path, rendering its use impractical in most occupied areas with normal ceiling heights.

AIR MOVEMENT

High air movement presents a special problem in detecting smoke for both point and smoke detectors because the propagation of smoke developing under normal conditions may not occur. High air velocity may also flush smoke out of the sensing chamber of a point detector, so careful consideration should be given to a point detector's performance where air velocities exceed 1.5 metres per second, or when air changes in the protected area exceed 7.5 changes per hour. Beam smoke detectors are not normally tested for stability in high airflow during approval testing because high air movement does not have as great an effect on their detection capabilities. Although reduced spacing is not normally required in high airflow areas, attention should be given to the anticipated behaviour of smoke in these applications.

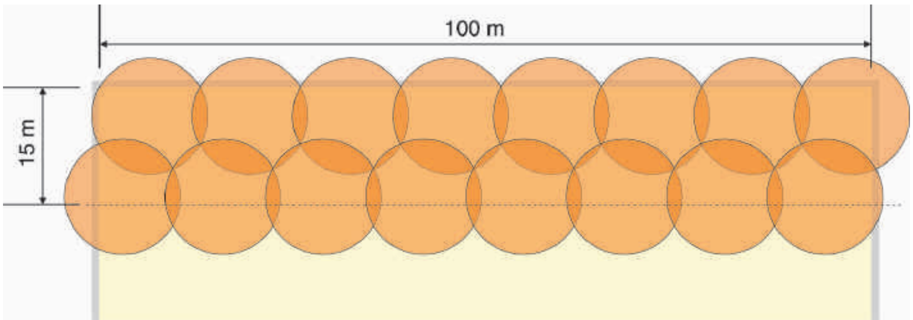


Figure 1b: point detector coverage over beam detector maximum area

TOLERANCE TO BUILDING MOVEMENT

Beam detectors require a very stable mounting surface for proper operation; a surface that moves, shifts, vibrates, or warps over time may cause false alarm or fault conditions. The detector should be mounted on a sturdy load-bearing wall, support column, structural beam or other surface that is not expected to experience vibration or movement over time. The unit can either be mounted directly to the structure of the building where typically ±10° of adjustment are provided, or, if for instance the detector needs to aligned on a diagonal across an area or has to be ceiling mounted, an adjustable mounting bracket that provides a much greater adjustment range can be used. If it is not possible to mount both components onto solid construction, then the transmitter should be fixed to the more solid surface, since movement of the reflector or receiver will have less effect than displacement of the transmitter.

A beam detector needs to be highly tolerant of movement in the building, which is subjected to various environmental forces. Wind, snow, rain and temperature changes can all cause a building to flex; for example, a 60km/h wind acting on a 100m^2 wall can generate a pressure of 4 tonnes. Over long ranges, even slight deformations of the mounting structure can cause the beam to move considerably from its target – over a 100m range, a movement of 0.5° at the transmitter will cause the centre point of the beam to move nearly 900mm. To ensure reliable operation, the beam detector should work satisfactorily with maximum angular misalignments of ±0.5° at the detector and ±10° at the reflector, allowing considerable temporary disturbances in the building's geometry to be accommodated without causing nuisance alarms or fault conditions to be generated.

INITIAL INSTALLATION AND SET-UP

The alignment of a beam detector is typically divided into four steps: coarse alignment, fine adjustment, gain adjustment and verification. The following description applies to a typical reflective beam detector; End-to-End beam detectors will require an extra procedure as it will be necessary to correctly align both ends of the transmitter/receiver pair. The initial coarse alignment is achieved by using an integral optical gun sight and horizontal and vertical alignment knobs to centre the reflector in the alignment mirror. Once the unit has been roughly aligned, the fine adjustment process can be carried out. A digital display is provided on the detector circuit board and the engineer adjusts the vertical and horizontal alignment screws to achieve the maximum possible value on the display. During this procedure, the detector monitors the beam, and will adjust its internal gain to achieve the optimum response. When the cover is replaced, the unit automatically makes one final internal gain adjustment.

The final step is for the engineer to

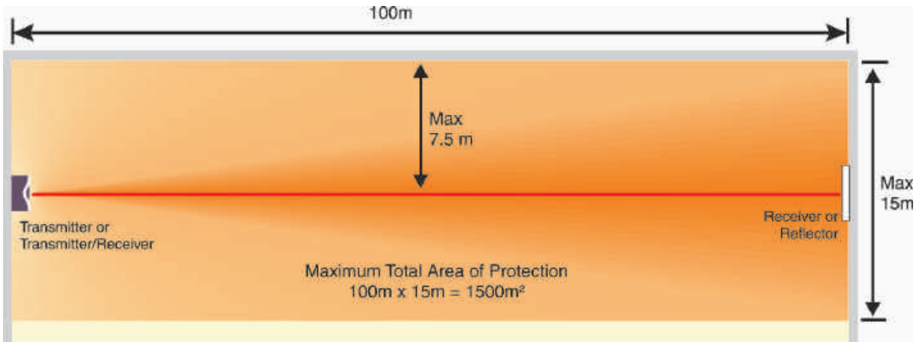


Figure 1c: maximum area coverage for beam detectors

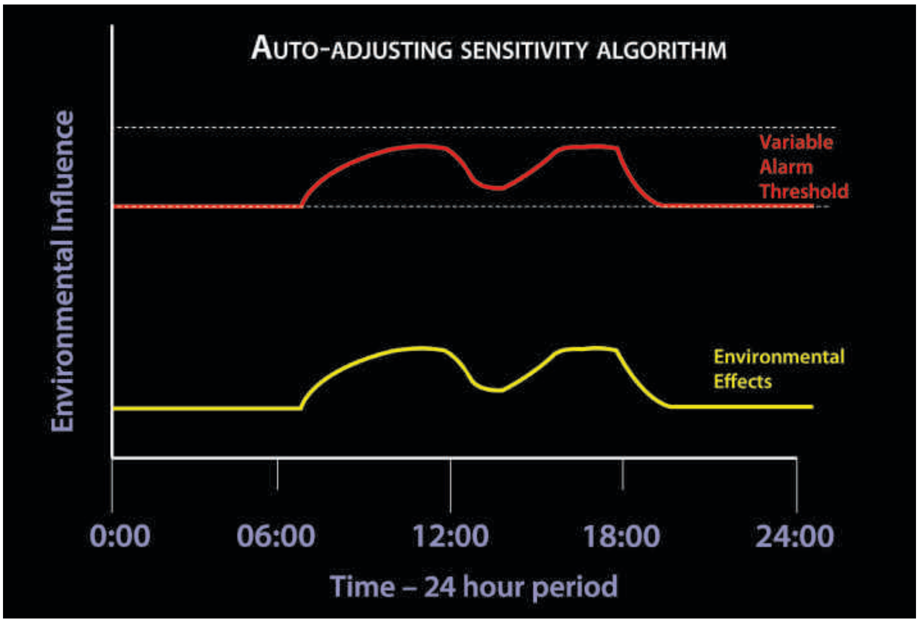


Figure 2: Auto short-term sensitivity adjustment

test the detector's fire and fault performance. Using a non-reflective opaque material, the reflector is completely blocked, which should cause a beam-blocked fault to be signalled after about 30 seconds. Sensitivity is then checked. The reflector is blocked to just below the relevant sensitivity setting using the graduated scale marked on the reflector – this should not cause any change to the beam state. Finally, the reflector should be blocked to just above the relative sensitivity setting, which should result in a fire alarm being signalled.

SENSITIVITY ADJUSTMENT AND DRIFT COMPENSATION

The perennial challenge for the detector manufacturer is the compromise in the sensitivity setting to balance performance between early detection of real fires and excessive nuisance alarms. In order to achieve optimum performance, technically advanced beam detector manufacturers provide automatic compensation to offset the effects of both short and long-term environmental changes. An auto-adjusting sensitivity algorithm automatically adjusts the alarm threshold over a period of hours to compensate for short-term changes in the protected environment, such as fork lift trucks active during the working day. Such adjustments do not compromise the detector's ability to respond quickly to a fire incident.

As dust builds upon a beam detector's optical components, its sensitivity will increase, leading to an increased susceptibility to nuisance alarms. Algorithms are provided to compensate for the gradual build up of dirt to maintain maintenance intervals whilst retaining constant sensitivity. However, the detector lenses and reflector (on a reflective type) will still need to be cleaned periodically. The maintenance interval will be dependant on site conditions: obviously enough, the dirtier the site the more frequently cleaning will be required.

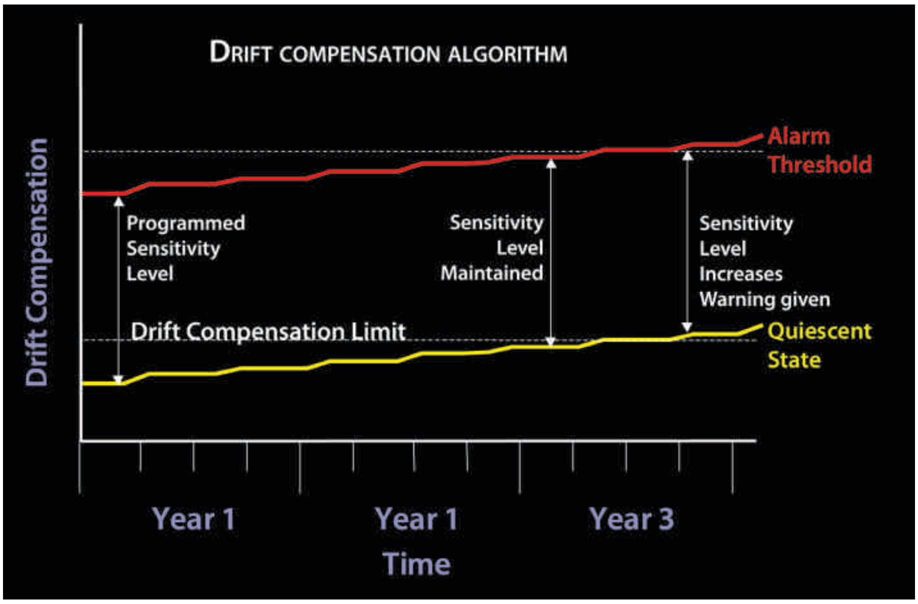


Figure 3: Auto long-term drift compensation

MAINTENANCE AND TEST

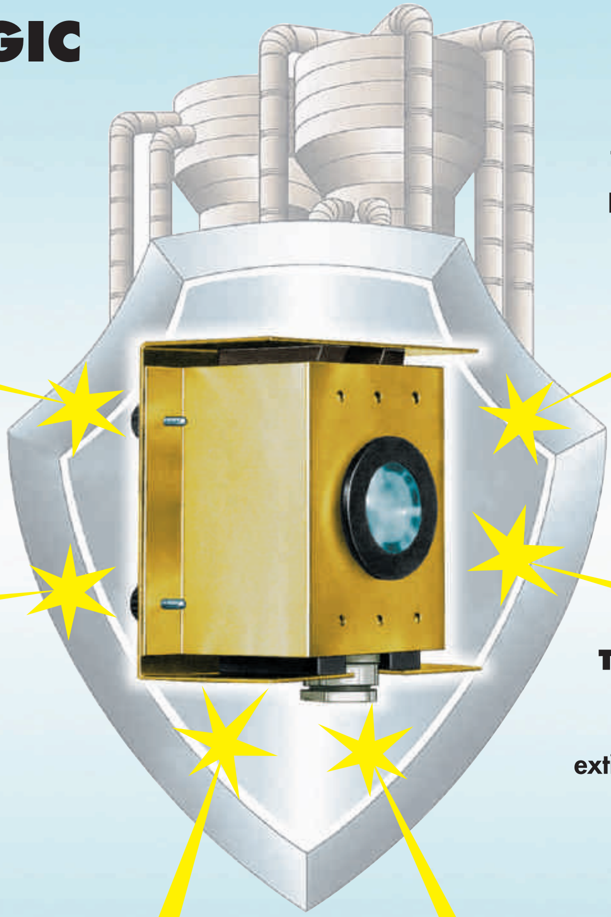
An issue associated with the installation of any smoke detector at a high level has been the need for costly and time-consuming access to the detector in order to conduct a full alarm test during annual routine maintenance. Most manufacturers provide remote test facilities for the electronics of their units, but the engineer would normally still be required manually to insert a filter into the beam in order to demonstrate that the device will go into alarm in the presence of smoke, the filter being an acceptable alternative to the smoke test normally required for point detectors. Only one manufacturer has so far developed conventional and addressable beam detectors fitted with a servo-controlled calibrated filter that can be moved in front of the receiver, simulating the effect of smoke entering the beam. If the correct signal reduction in the returned light is detected then the unit will enter the alarm condition, otherwise a fault signal is returned. This functionality, known as Asuretest, meets the periodic maintenance and testing requirements of most local standards as it fully exercises the complete alarm path, testing both the electronics and optics of the unit. Asuretest can be initiated from the ground level Remote Test Switch or, in the addressable version, directly from the control panel.

CONCLUSIONS

Beam detectors give fire system designers an effective way of providing cost-effective protection of large high-ceilinged areas. Recent advances in set-up, automatic sensitivity adjustment and testing make the deployment of beam detectors as part of a fire detection system a less complicated and easier to manage option. In particular, System Sensor's remotely initiated Asuretest function, which provides a complete test of the optical and electronic elements of the alarm path, satisfies local standards, means that high level access equipment will not have to be hired, the Health and Safety implications associated with high-level working are not relevant and the costs of routine maintenance are significantly reduced.

CONTROL LOGIC Spark detector

designed for dust collection systems to protect storage silos from the risk of fire.



Sparks fly at high speed.

They travel at a hundred kilometres per hour along the ducts of the dust collection system and reach the silo in less than three seconds

The CONTROL LOGIC SPARK DETECTOR is faster than the sparks themselves. It detects them with its highly sensitive infrared sensor, intercepts and extinguishes them in a flash. It needs no periodic inspection.

The CONTROL LOGIC system is designed for "total supervision". It verifies that sparks have been extinguished, gives prompt warning of any malfunction and, if needed, cuts off the duct and stops the fan.

ISO 9001

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Tel.: + 39 02 5410 0818 - Fax + 39 02 5410 0764
E-mail: controllogic@controllogic.it - Web: www.controllogic.it

CONTROL LOGIC s.r.l.

BETTER *TO KNOW* IT BEFORE

Eye is faster than nose.

In the event of live fire
the IR FLAME DETECTOR
responds immediately

CONTROL LOGIC IR FLAME DETECTOR

the fastest and most effective fire alarm device for industrial applications

**IR FLAME DETECTOR
RIV-601/FA
EXPLOSIONPROOF
ENCLOSURE**

For industrial applications indoors or outdoors where is a risk of explosion and where the explosionproof protection is required.
One detector can monitor a vast area and responds immediately to the fire, yet of small size.

Also for
RS485 two-wire serial line

**IR FLAME DETECTOR
RIV-601/F
WATERTIGHT
IP 65 ENCLOSURE**

For industrial applications indoors or outdoors where fire can spread out rapidly due to the presence of highly inflammable materials, and where vast premises need an optical detector with a great sensitivity and large field of view.

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CONTROL LOGIC s.r.l.

CGI GLASS MEETS EUROPEAN STANDARDS

Specialist fire glass manufacturer **CGI International** achieved a first when its Pyroguard fire-resistant glass, which at only 7mm can be used in standard profiles for partitioning, was tested successfully to stringent new European standards.

This important fire test, using large sheets of the glass, was carried out in conjunction with partition system maker Maars API, and met the new EN 1364 standard which is accepted across most of the EU, including the 10 new member countries.

Using CGI's Pyroguard unwired fire glass has also been made even easier for glaziers, door manufacturers and joiners now that it has a substantially extended listing shown on its revised CERTIFIRE documentation. A huge increase in the number of completed tests by Pyroguard's manufacturer, CGI International, has led to a much larger list of compatible glazing systems.

The new EN 1364 accreditation was achieved when Maars and CGI tested a new pressed steel profile frame, featuring a spaced dual-glaze system. One side was glazed with standard 6mm tempered glass and the fire-resisting glass element was provided by CGI's laminated 7mm Pyroguard.

The test featured full-height glass panels, within the 4m by 3m test furnace, and the individual panes of 872mm and 2590mm reached the 30-minute standard. For the EN test, a new measurement of the total transmitted heat is used, which leads to a heat flux measurement expressed in kW/m^2. To reach the EW 30 classification level, the heat emission from the whole construction must measure less than 15kW/m^2, and despite the huge glazed area in the test, an emission level of just 11.6 kW/m^2 was measured.

Tom Ritchie, CGI's chief executive, says, "The significance of this is that many of the commonly used fire glasses will fail this test in the sizes we tested – over 2500mm high – by a margin of over 100%. In the past, the only way to meet the 15kW limit was to use a much thicker, and much more expensive, glass."

The test was carried out at the TNO test centre at Delft, in the Netherlands, and one reason for using the TNO-Dutch national test facility was to ensure that compliance was confirmed to the important radiant heat transfer levels as demanded in the Netherlands and which are now a feature of all European-Norm fire tests.

Maars, one of the largest partitioning manufacturers in the Netherlands and with a subsidiary office in the UK, handled all the technical elements of the test through its head office at Harderwyjk, with input on glass design by CGI.

The CERTIFIRE Certificate of Approval is run by the Warrington Fire Research Centre, where testing is carried out. Included in the documentation is a list of CERTIFIRE approved products for use with the 7.2mm Pyroguard glass. The revised Pyroguard CERTIFIRE Certificate No CF 257 carries details of the tests and assessments of 11 different glazing systems from five separate sealant manufacturers, providing a very wide test base to choose from.

CGI International offers a complete range of fire products to fulfil a wide variety of performances and appearances enabling specifiers to obtain all their requirements for fire and speciality glass from a single source. CGI, whose products are now used all over the world, earlier this year won the Queen's Award for Enterprise: International Trade, 2004.

For further information, please contact:
CGI International Ltd
Email: alison.emerson@cgii.co.uk

NIGEL STOCKWELL

It is with deepest regret that we have to announce the unexpected death of **Nigel Stockwell**, Managing Director of Cranford Controls Ltd. He passed away on Tuesday 4th January 2005 whilst on holiday with his family.

He was extremely proud of Cranford's achievements and especially the team of people that helped him accomplish such a successful company.

The Directors and staff at Cranford will ensure the company continues to go from strength to strength, as Nigel would have wished.

INTERNATIONAL FIRE EXPO 2005: RETURN OF THE ULTIMATE FIRE EVENT

International Fire Expo is one of the industry's best-supported fire events, with virtually every key UK fire body involved for 2005. The event now spans all aspects of fire fighting, including fleet management and fire rescue, through to fire prevention and protection. It returns to the NEC Birmingham from May 16–19 2005.

The Joint Oil Industry Fire Federation (JOIFF) will be holding its annual meeting at the event. The Fire Fighting Vehicle Manufacturers Association (FFVMA), the Transport Officers Group, the Federation of British Fire Organisations (FOBFO) and the Fire Industry Confederation (FIC) are all actively supporting the show, cementing its position as the leading event for the entire fire industry.

Visitors will also have more to see in 2005 with more companies exhibiting than in previous years. A record line up of exhibitors is already confirmed including Apollo Fire Detectors Ltd, Nittan (UK) Ltd, and Chubb Fire Ltd. Organiser **CMPi** has developed new features to cover subjects pertinent to professionals, spanning the health, fire and rescue sectors, as well as the event's established markets of prevention and protection technology.

An informative programme of seminar sessions will cater for all sides of the spectrum from fire fighting to engineering. Sessions already confirmed include an interactive seminar hosted by the London Fire Brigade on the new national procurement strategy 'Fire Buy', which comes into effect on the 1st April 2005. FOBFO will also host a seminar session entitled 'The Fire Service – Working Effectively on Health Agendas' on May 18. Exhibiting companies are also invited to deliver generic presentations in their areas of expertise.

Confirmed speakers include John Ransford, lead officer on Public Health and fire at Local Government Association (LGA) and Alan Doig president of the Chief Fire Officers' Association (CFOA). FOBFO chairman and Lancashire Fire and Rescue CFO Peter Holland will be chairing the discussion.

The popular Emergency Action Zone returns in 2005 featuring a series of live demonstrations, road traffic incident simulations, fire rescue and outdoor extinguishing practices outside the NEC hall.

International Fire Expo is one of Europe's leading fire events and returns to Birmingham's NEC from May 16–19 2005. Free visitor pre-registration is available at www.fire-expo.co.uk, together with the latest updates on show news and exhibiting companies. The event adjoins security show IFSEC, Safety & Health Expo, policing event the ACPO Exhibition and Conference, and The Facilities Show. Companies interested in exhibiting should contact Gerry Dunphy on +44 (0) 207 921 8063 or email gdunphy@cmp-information.com.

For further information, please contact:
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HIGH INTENSITY STROBES/STEADY LIGHTS FROM MEDC

Up to 580,000 Candlepower, Models XB15, FB15 & XB16, ATEX Approved & UL Listed

MEDC, the manufacturer of alarm, signal, control and communications equipment for potentially explosive atmospheres and harsh environments is pleased to announce the launch of its latest visual alarms for hazardous locations, the XB15, XB16 and FB15.

These new products has been designed for the US market with pipe mount fittings and have been UL Listed for hazardous and ordinary locations. The XB15 and FB15 are additionally available ATEX approved. The XB16 is available compliant to UL1971 (ADA).

With a high ingress protection rating and heavy duty construction these units are ideal for industrial applications both onshore and offshore. With high intensity output, these units offer ease of installation and compact size.

Outline specifications are:

• Application	Zone 1 & 2 (Gas & Dust) use, hazardous and ordinary location.
• ATEX	ATEX approved Ex II 2GD (XB15 & FB15 only).
• UL Listed	UL Listed for Class I, Div 2, Groups A-D UL Listed for Class I, Zone 1 AExd IIC T3/T4/T5/T6∞C
• Ingress Protection	IP66 & 67/NEMA 4x & 6.
• Ambient Temperature	−55°C to +70°C.
• Tube Energy (XB15/XB16)	10 Joules (XB16), 15 Joules (XB15).
• Lamp Rating (FB15)	60/100W lamp (FB15)
• Material	Corrosion-free GRP and stainless steel construction.
• Options	Relay Initiate, Lens Guard, Flashrate, Lens & Body Colour, Voltage.

For more information, please contact:
MEDC Ltd
Tel: +44 (0)1773 864130
Email: mknox@medc.com

BSI DEPLOYS NO CLIMB'S SMOKE & HEAT TUNNELS

The **British Standards Institution Group** (BSI) has purchased Smoke and Heat Tunnels from No Climb Products Limited in partnership with AW Technology Limited to increase its capabilities for testing and Kitemark certification services for the Fire industry.

The Smoke Tunnel is designed to test smoke detectors to BS5446: Part 1, ISO 12239, EN54 Part 7 and, when published, the new British and European standard for domestic smoke alarms BS EN 14601. The tunnel, manufactured by AW Technology in Leicester, comprises of a recirculating duct constructed of sheet steel and lined in stainless steel. It includes aerodynamic features to smooth the airflow at the test positions. A high performance optical obscuration meter is fitted to monitor aerosol concentration and an ionisation reference is used for testing ionisation detectors. The smoke tunnel is computer controlled with a clear user interface and fully automatic test cycles. The standard test cycle ramps up

the aerosol (or filter paper smoke) concentration in order to measure the alarm sensitivity of detectors under test. The ramp rate can be adjusted to improve accuracy or speed testing.

The second tunnel supplied can carry out smoke detector testing, but is also equipped with 15kW heaters to enable testing of heat detectors to BS5446: Part 2 or EN54 Part 5. Automatic heat test cycles range from dual rate 'static' tests at 0.2°C/minute to very fast ramps up to 30°C/minute.

BSI's Product Services Division will also be able to offer a service where manufacturers can undertake research and product development testing.

Torben Cox, Sales and Marketing Director at No Climb, said "The fact that the BSI has made this investment in the Smoke and Heat Tunnels is testament to the clear benefits it offers, such as improving response and delivery times for customers, assisting manufacturers with R&D, and helping clients conform to British Standards regulations. No Climb is delighted to have increased its product range, at the same time strengthening its unique service to the Industry."

Anne Boyd, Managing Director of BSI Product Services commented "The BSI Kitemark has been associated with fire products for over 25 years. The addition of the smoke and heat tunnels, to our established detector testing capabilities, represents a significant investment and commitment to the fire industry. As well as building on our experience and enhancing our certification service offering, BSI increases the choice of testing facilities available to manufacturers. The procurement and installation of this test equipment will enable BSI to improve response and delivery times for clients."

For more information, please contact:
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Fax: + 44 (0) 1707 282777
Email: caryn.cooper@noclimb.com
Website: www.noclimb.com

NEW 108FPS PUTS THE PRESSURE ON

After 50 years of success in the industry, **OCV Control Valves** is introducing a new model into its fire valve family. The 108FPS can sustain pressures as low as 5 psi and is Factory Mutual approved.

OCV's 108FPS valve prevents the fire pump from outdrawing the available supply by maintaining minimum pump suction pressure and ensuring adequate pressure is supplied to the fire system components. This protects the pump from damage associated with dangerously low pressure levels or backflow. The suction pressure may be adjusted between 5 and 30 psi by a single screw.

The 108FPS is installed on the discharge pump and controls the suction pressure of a fire pump to prevent the pressure from falling below a predetermined minimum. As long as the pump suction pressure is above the set point, the valve will open fully

and allow full pump flow; however, if the pump suction pressure falls below the set point, the valve begins to close and throttle flow to prevent pump suction pressure from falling any further.

"The adjustment range is wider than other comparable products on the market, which makes it easier to fine-tune your system," said OCV engineer Ron Smith. This model is pilot operated by the main valve and can be serviced without removal from the line. The 108FPS is available in sizes varying from 3″ to 8″ in both the globe and angle styles. This model can be pre-set to your requirements and is constructed using ductile iron with 100% epoxy coating.

OCV is a global leader in the control valve industry and can be found in some capacity in nearly every country in the world. To prove its dedication to providing the finest customer service, OCV's quality system is ISO 9001 certified and the company strives to exceed industry standards across the globe. For further information on the 108FPS, call 1-888-OCV-VALV (USA only) or 918-627-1942.

For more information, please contact:
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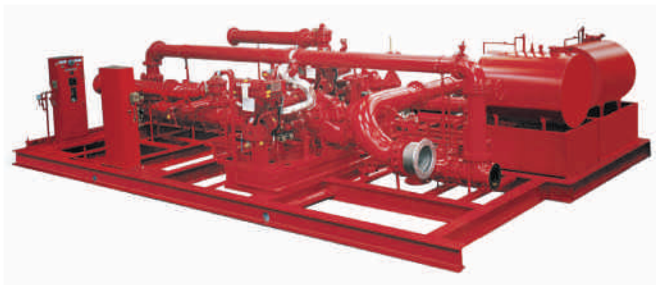

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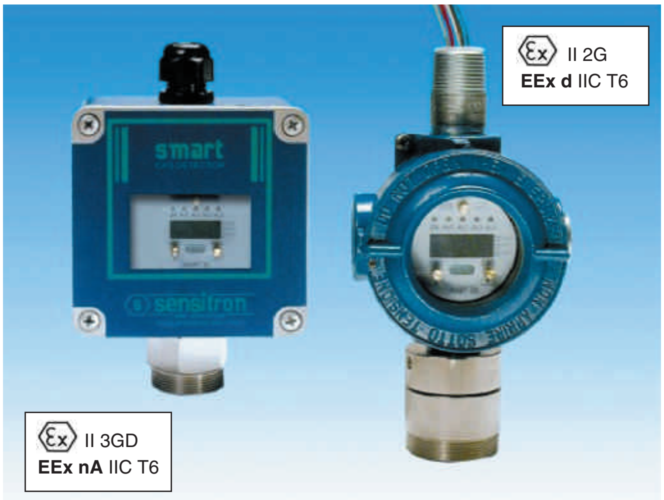

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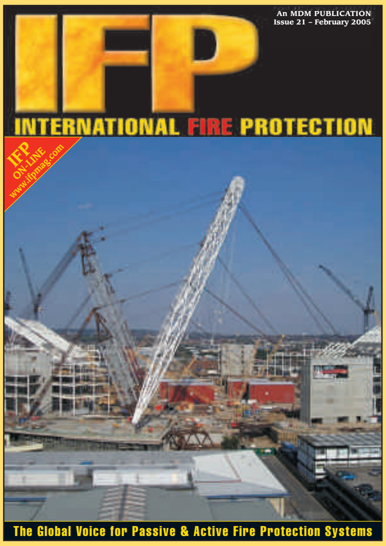

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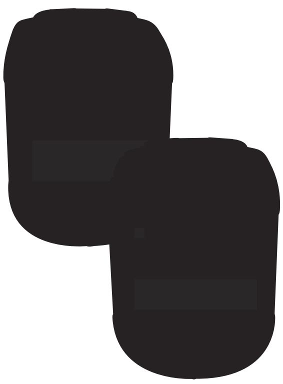

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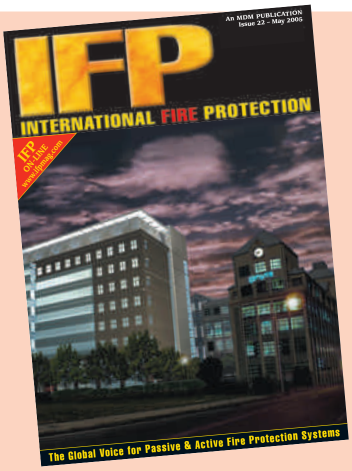

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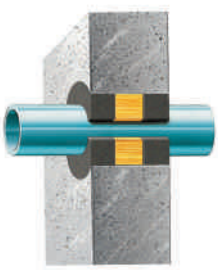

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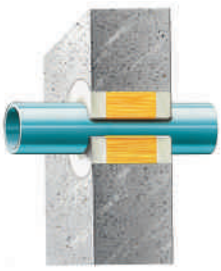

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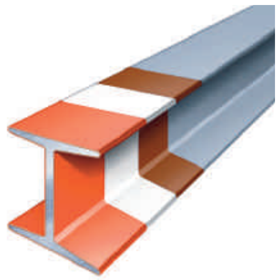

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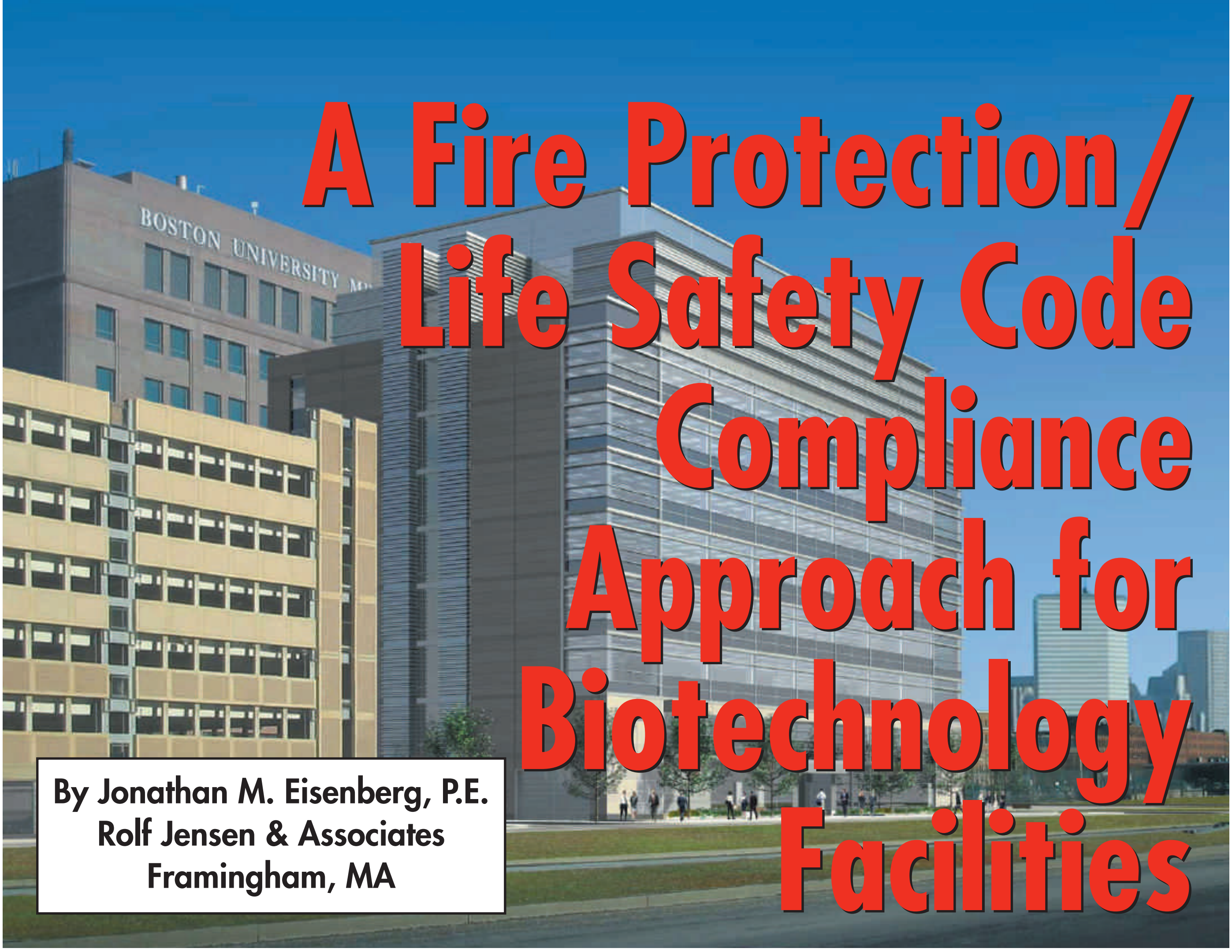

A Fire Protection/ Life Safety Code Compliance Approach for Biotechnology Facilities

By Jonathan M. Eisenberg, P.E.
Rolf Jensen & Associates
Framingham, MA

Pic courtesy of Rolf Jensen & Associates

AN INCREASING NUMBER OF biotechnology laboratory and manufacturing facilities are being built in response to the demand of the health care industries for improved and more specific pharmaceuticals, and the availability of talented researchers and scientists. The volumes of hazardous materials needed in a biotechnology facility vary, depending on the type of research and product. For example, some facilities place a greater emphasis on chemistry activities, and consequently store and use larger quantities of materials. From a fire protection and life safety standpoint, the model codes contain several design approaches for the storage and use of hazardous materials in such facilities. This article provides details of three code compliance approaches for fire protection and compartmentation, based on the major applicable requirements contained in the 2003 International Building Code (IBC) and NFPA 45, *Standard for Fire Protection in Laboratories Using Chemicals* (2000 Edition).

CONTROL AREAS AND EXEMPT AMOUNT APPROACH

The IBC defines a **control area** as an area within a building that contains up to the maximum quantity of the **exempt amounts** of hazardous materials, as listed in IBC Tables 307.7 (1) and (2). A control area can be made up of several laboratories, an entire floor, or an entire building; a multi-story control area is also possible and is allowed by the IBC. The size (floor area) is not limited for a control area. The “exempt amount” refers to quantities that are “exempt” from the IBC requirements for a Use Group H (High Hazard) occupancy.

The IBC regulates quantities of hazardous materials in storage and in use, by physical and health hazard. The tabular exempt amount quantities are permitted to be increased by 100% for a fully sprinklered building, and another 100% (accumulatively) for storage in approved cabinets or exhausted enclosures. When calculating the actual vs. allowable exempt quantities, the practitioner should be mindful of the units

Table 1 – Control Areas and Exempt Amounts (from IBC Table 414.2.2)

Floor Level	Percent of Exempt Amounts per Control Area	Number of Control Areas per Floor	Rating of Fire Separation Assembly (hours)
Sub-Basement	50	2	1
Basement	75	3	1
1	100	4	1
2	75	3	1
3	50	2	1
4 – 6	12.5	2	2
7 – 8	5	2	2

Pic courtesy of Rolf Jensen & Associates

employed by the IBC tables. For example, several classifications of liquids such as oxidizers are listed in units of mass (pounds), rather than in units of volume (gallons).

Table 1 on page 5 lists the maximum number of control areas per floor, along with the percentage of exempt amounts permitted per control area, and the required vertical separation between adjacent control areas. For example:

- 1st Floor – 4 control areas allowed; 100% of exempt amounts; 1-hour vertical fire separation between control areas; 45-minute opening protectives
- 4th Floor – 2 control areas allowed; 12.5% of exempt amounts; 2-hour vertical fire separation between control areas; 90-minute opening protectives

As noted in Table 1, the IBC prohibits control areas more than 2 levels below grade. In addition, the 2003 International Fire Code (IFC) prohibits Class I (flammable) liquids in any below-grade control areas. These restrictions are based on the problems faced by the fire service in reaching and fighting a flammable liquid fire in a below-grade space.

The IBC requires control areas within a building to also be separated by 2-hour fire resistance rated floor construction. This can present issues in building construction, since many biotechnology laboratory buildings are of Type 2B, noncombustible, unprotected construction. The floors in such buildings do not carry a fire resistance rating and cannot be divided into the maximum number of control areas. This type of building construction, although compliant as a Use Group B (Business) occupancy, cannot easily support research activities that require appreciable quantities of hazardous materials. Unfortunately, many shell-and-core buildings are designed without taking into account the future need for control area subdivision. At the time of tenant fit-outs, 2-hour fire proofing is added to the floors as a retro-fit to provide greater flexibility for the new biotechnology tenants.

The IBC exempt quantity limits per control area become problematic for biotechnology facilities located above the 3rd Floor in a building. The significant drop in the exempt quantity limits conflicts with the tendency of designers to place laboratories on the upper floors, in an effort to minimize exhaust duct runs to the mechanical penthouse. Table 2 below provides an example of this quantity issue for Class IB flammable liquids on the 4th Floor (12.5% of the exempt amounts allowed), vs. the 3rd Floor (50% allowed).

An exempt quantity limit of 30 gallons of Class IB liquids per control area on the 4th Floor can present operational issues for a biotechnology facility.

In terms of other fire protection features required by the IBC for control areas –

- Dedicated exhaust is not required for each control area
- Sprinkler density, although not specifically listed, is normally based on an at least an NFPA 13 Ordinary Hazard Group 1 designation

NFPA 45 LABORATORY UNIT APPROACH

A second commonly-used design approach for biotechnology facilities is the laboratory unit approach contained in NFPA 45. Similar to the control area approach, a laboratory unit can be a single or group of laboratory spaces, an entire floor, or an entire building. NFPA 45 uses area and quantity limits, along with fire separations, toward the goal of confining a laboratory fire to the area of origin. This not only allows the occupants to egress in a safe and timely manner during a fire emergency, but also limits the damage and business interruption to the biotechnology facility.

NFPA 45 defines Class A, B, C, and D laboratory units as noted in Table 3 on page 8.

In contrast with the IBC control area restrictions, NFPA 45 does not limit the number of laboratory units per floor, and does not reduce the allowable quantities based on vertical location in a building. Also, while not explicitly stated in the NFPA 45 text, all supporting construction for Class A and B laboratory units must carry the corresponding fire resistance rating. As discussed earlier in this article, sub-division of a building

Table 2 – Class IB Flammable Liquid Quantities Allowed Per Control Area (from IBC Tables 414.2.2 and 307.7 (1))

Floor Level	Percent of Exempt Amounts per Control Area	Class IB Flammable Liquids Permitted in Storage per Control Area (gal)
3	50	120
4	12.5	30

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Table 3 – NFPA 45 Laboratory Units (NFPA 45, Table 3.1.1 (a))

Laboratory Unit Classification	Area Limit per Laboratory Unit (ft^2)	Vertical Fire Separation (hrs)
A	10,000	2
B	10,000	1
C	None	NC[a]
D	None	NC

a – Noncombustible

with no structural fire resistance rating into Class A and B laboratory units could be problematic.

In terms of hazardous material quantities, NFPA 45 only places limits on Class I flammable liquids and Class II/IIIA combustible liquids, as shown in Table 4 below (for a fully sprinklered building). The density limit is imposed in order to prevent storage or use of significant quantities of flammable and combustible liquids in relatively small laboratory spaces.

Since NFPA 45 does not regulate the full spectrum of hazardous material classifications, the IBC exempt quantity limits apply, other than for Class I, II, and IIIA liquids. In some jurisdictions, the Authority Having Jurisdiction (AHJ) may require application of both the IBC control area approach and NFPA 45. In cases where the two codes overlap on a particular issue, the more restrictive requirements apply.

In terms of other fire protection features required by NFPA 45 for laboratory units:

- Dedicated exhaust is required for each laboratory unit, to the exterior, to a rated shaft, or to a mechanical penthouse. This provision allows the laboratory hood exhausts to be manifolded within a given laboratory unit.
- Fire dampers are not permitted in lab exhaust duct systems. In lieu of fire dampers, either of the following designs is compliant:
  - Enclosure of the exhaust duct for 10 feet on either side of a rated penetration, with construction equivalent in rating to the assembly penetrated
  - The use of subducts, as described in NFPA 45, 6.10.3, which permits the use of dedicated exhaust duct risers routed to the mechanical penthouse. The dedicated exhaust ducts create, in effect, subducts within the rated shaft that extend greater than 22 inches.
- Sprinkler density is specified as NFPA 13 Ordinary Hazard Group 2 for Class A and B laboratory units, and Ordinary Hazard Group 1 for Class C and D laboratory units
- A second means of access to an exit from a lab work area is required if any of the following conditions exist:
  - (a) A work area contains an explosion hazard that would block escape from or access to the work area.
  - (b) A lab work area exceeds 1,000 sq.ft.
  - (c) A hood in a lab work area is located adjacent to the primary means of exit access.
  - (d) There is a compressed gas cylinder in use that is: larger than lecture bottle size; contains a flammable gas or health hazard rating or 3 or 4; could prevent safe egress in the event of accidental discharge of cylinder contents
  - (e) There is a cryogenic container in use that: contains a flammable gas or health hazard rating of 3 or 4; could prevent safe egress in the event of accidental discharge of cylinder contents

Table 5 on page 10 presents a summary of similarities and differences between the IBC control area approach and the NFPA 45 laboratory unit approach.

Table 4 – NFPA 45 Quantity Limits per Laboratory Unit (based on NFPA 45, Table 2.2.1 (a))

Laboratory Unit Classification	Max. Quantity – Class I Flammable Liquids per Lab Unit (gal)	Max. Quantity – Class I, II, IIIA Liquids per Lab Unit (gal)
A	1,200 or 20 gal/100 sq.ft.[1]	1,600 or 8 gal/100 sq.ft.[1]
B	600 or 10 gal/100 sq.ft.	800 or 20 gal/100 sq.ft.
C	300 or 5 gal/100 sq.ft.	400 or 8 gal/100 sq.ft.
D	150 or 2 gal/100 sq.ft.	150 or 2 gal/100 sq.ft.

[1]Includes quantities in laboratory storage cabinets and safety cans

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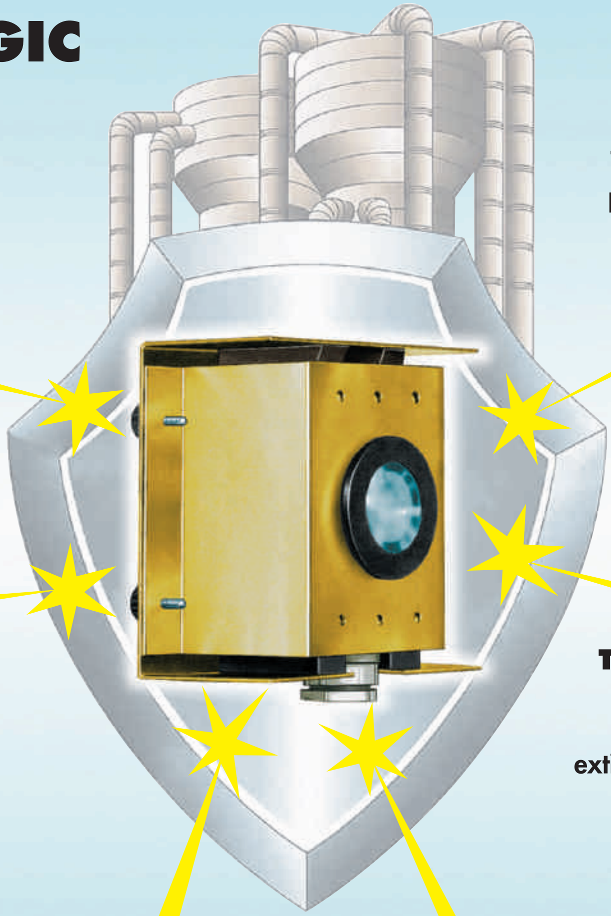

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Table 5 – Control Areas vs. Laboratory Units

Control Areas (IBC)	Laboratory Units (NFPA 45)
Limit on the number of control areas per floor	No limit on the number of lab units per floor or per building
No limit on the size of a control area	Maximum of 10,000 sq.ft. for Class A and B lab units
	No limit on the size of Class C and D lab units
Each control area is limited to the exempt amounts of hazardous materials – IBC Tables 307.7 (1) and 307.7 (2); amounts decrease for floor levels above and below grade	Each lab unit is limited to a maximum quantity of flammable and combustible liquids – NFPA 45, Table 2.2.1 (a)
1 or 2-hour fire separation (including glass) between control areas, with 2-hour floors and supporting construction	2-hour fire separation and supporting construction for Class A lab units 1-hour fire separation and supporting construction for Class B lab units NC separation for Class C and D lab units
No dedicated ventilation required for each control area	Each lab unit should be exhausted to the outside; or to a mechanical penthouse; or to a rated shaft

USE GROUP H (HIGH HAZARD) OCCUPANCY APPROACH

A third design approach for biotechnology facilities is the classification of large floor areas of a building as Use Group H (High Hazard) occupancies. Although used far less frequently than the IBC control area or NFPA 45 laboratory unit approaches, the Use Group H concept provides the greatest flexibility in terms of allowable hazardous material quantities. However, along with this flexibility come many IBC requirements, which are much more restrictive than for a Use Group B (Business) occupancy and result in higher capital costs.

One possible approach under the Use Group H category is a Use Group H-2 occupancy, which allows unlimited quantities of certain classes of hazardous materials, compared with the control area exempt amount limits. This has a significant impact for biotechnology facilities, which use appreciable volumes of Class IB flammable liquids (common solvents, such as acetone, methanol, and toluene).

A limitation to consider for Use Group H-2 occupancies is their vertical placement in a building. Table 6 below shows the height and area limitations for a Use Group H-2 occupancy, based on building construction type.

It should be noted that sprinkler increases for height and area cannot be taken for Use Group H occupancies.

Another architectural restriction contained in the IBC is a requirement that at least 25% of the perimeter of a Use Group H-2 occupancy must be on an exterior wall, for fire fighting purposes and potential deflagration venting. Also, the maximum travel distance to an exit from the most remote point in a Use Group H-2 occupancy is 100 feet. Horizontal exiting into adjacent Use Group B areas can be used to meet travel distance limitations.

Exterior wall rating requirements for Use Group H-2 occupancies are also more stringent than for Use Group B occupancies. The exterior wall of the Use Group H-2 area should be a minimum of 30 feet from an interior lot line.

Table 6 – Use Group H-2 Occupancy – Height/Area Limits (IBC Table 503)

Construction Type	Base Area Limit (ft^2)	Base Height Limit (# of stories)
IA	21,000	Unlimited
IB	16,500	3
IIA	11,000	2
IIB	7,000	1

In terms of other fire protection features required by the IBC for Use Group H-2 occupancies –

- A two (2)-hour fire separation (and supporting construction) is needed between the H-2 spaces and any B occupancies.
- One (1)-hour fire resistance rated corridors are required.
- Dedicated exhaust is required.
- Sprinkler density, although not specifically listed, is normally based on an at least an NFPA 13 Extra Hazard Group 1 designation.
- A Class 1, Division 1 or 2 electrical classification may be required for certain portions of the Use Group H-2 space, depending on the laboratory processes and materials used.
- Explosion control may be required, depending on the types and quantities of hazardous materials present.
- Spill control, secondary containment, and drainage for the largest container and fire protection water may be required, depending on the material types, quantities, and container sizes used in the laboratories.
- Monitor control equipment, standby or emergency power, and a local hazardous materials alarm system are required.
- Smoke and heat venting is required for Use Group H-2 spaces greater than 15,000 square feet.

SUMMARY

Biotechnology facilities present unique fire protection and life safety challenges, given the nature of the hazardous materials stored and used. The model codes contain three approaches for compartmentalization of such facilities – control areas/exempt amounts, laboratory units, and High Hazard occupancies. The local building and fire officials should be consulted prior to finalizing the design approach.

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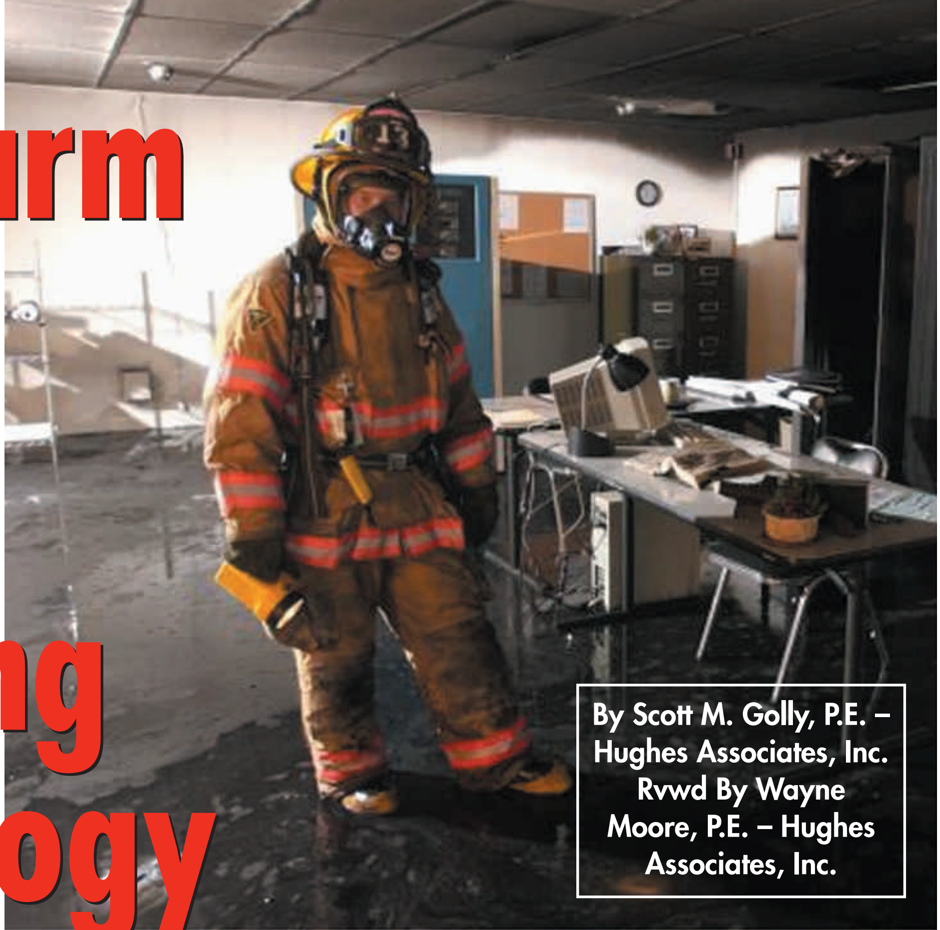
Fire Alarm Control Units – Changing Technology



By Scott M. Golly, P.E. – Hughes Associates, Inc. Rvwd By Wayne Moore, P.E. – Hughes Associates, Inc.

Pic courtesy of Hughes Associates, Inc.

IN A WORLD WHERE cellular telephones can record digital movies yet still remain less than ½ inch thick, one would tend to think that the fire alarm industry would be further advanced than it seems to be. In reality, fire alarm systems are amazingly advanced but are limited in their rate of growth for several reasons.

It is not acceptable to rush technology into field use for an industry that has the important responsibility to protect life and property in a reliable manner. Fire alarm control units (FACUs) must be thoroughly tested by a third party testing laboratory before they can be considered for distribution. The test process helps to ensure a minimum acceptable level of reliability based on an appropriate test standard and conformance with the nationally accepted Fire Alarm Code.

The U.S. codes require that fire alarm control units and their associated components be tested and listed by Underwriters Laboratories Incorporated (ULI) or FM Global (FM). The testing and listing process serves many purposes but most importantly, ensures that the technology is reliable and will operate as specified by the manufacturer.

The goal is to ensure that the FACU will also be stable once it is installed under field conditions.

As a volunteer firefighter, I have personally dealt with false alarms and observed the dissatisfaction of both owners and responders when systems false alarm. Usually, these problem systems are a result of poor installation, poor maintenance, or antiquated technologies. False alarms reduce confidence in the installed system and cause reluctance of those being protected to trust the new technology and respond appropriately when there is an alarm. When confidence is lost in a system, people stop taking it seriously.

On the other hand, I have responded to building fires where a reliable fire alarm and detection system was responsible for saving lives and property.

Fire alarm control unit manufacturers have made every effort to meet the needs of their customers with newer analog and digital addressable technology while still focusing on the operational reliability of the FACUs they produce. However, as we move into the age of new technology, we are creating more complicated systems to program and operate.

Limiting the accessibility to the FACU is important to ensure that only trained and capable technicians make the necessary programming adjustments for proper FACU operation. Based on the often complicated programming requirements of new FACU's, it is important to verify the changes or confirm reasons for the necessity of changes to the FACU. Improperly programmed FACU's result in impairments

False alarms reduce confidence in the installed system and cause reluctance of those being protected to trust the new technology and respond appropriately when there is an alarm.

Fire Alarm Control Units – Changing Technology

and these impairments can seriously impact or eliminate the life safety afforded by the fire alarm system.

Some manufacturers have developed systems that can be remotely programmed to allow a complete download of the FACU operation matrix as well as the addresses of the devices. Once the critical information and programming has been done remotely, field installers can connect the devices and test the system to ensure that the remote programming was successful.

CONTROL UNIT BASICS

Conventional fire alarm systems are still readily available and used for smaller installations or releasing functions but they are quickly being phased out of production as less expensive addressable FACU's enter the market. Conventional fire alarm control units are now microprocessor based but they are still limited in the amount of information that can be obtained from the field sensors. Communication is limited to sensing of contact closure giving only the zone in alarm. Conventional being defined as initiation device circuits that cannot differentiate by specific initiation device rather by groups of devices hard-wired to each specific initiation zone.

Addressable systems become more cost effective to install on larger projects due to reduced cable and labor requirements.

Addressable fire alarm control units are capable of supervising the equipment connected to them at levels that, in most cases, exceed that of industrial computer network configurations. Supervision capabilities include circuit opens, ground faults, wire to wire shorts, power losses, resistance changes, status changes, device loss, communication problems, and circuit tampering. Device status changes can be as simple as sensitivity changes (dirt or smoke), drift compensation, alarm, and device or communication failure.

Battery backup for durations of at least 24 hours in standby and 5 minutes or more in alarm with full supervision of the power supply and charger has become the current standard for fire alarm systems. Fire alarm control unit battery backup is typically integral to the control unit housing or can be remotely mounted. Most manufacturers offer software packages to calculate the size of the batteries required as well as many other required calculations.

NETWORKING TECHNOLOGIES

Networking capabilities in the fire alarm industry are almost endless. Most manufacturers produce methods of interconnecting with the internet or corporate intranet as well as many other building automation control networks. Networking technologies that can be used to integrate the fire alarm control units with building automation systems include:

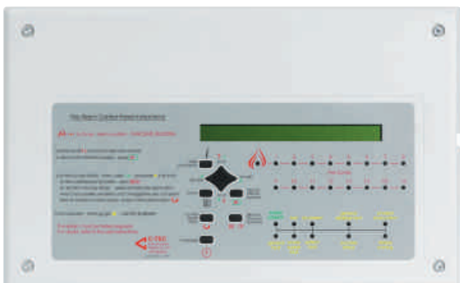
- MODBus;
- BACNet (Building Automation and Control Network);
- LONWorks;
- EIA-485;
- CEBus;
- EtherNet; and
- Internet Protocol.

These networks can be connected in many ways including wireless, fiber optic, and copper. The interfaces between fire alarm control units and other networks can be via gateways or bridges that may contain Echelon chips for LonWorks or gateways that allow interconnection with the other networks listed. Some of the fire alarm control unit manufacturers have developed networks within a fire alarm system that use LonWorks with proprietary user interfaces.

USER INTERFACE

Fire alarm control unit manufacturers continue to refine software interfaces to allow the configuration of extremely complex control and supervision functions with relative ease. Most fire alarm control units are capable of performing timed control functions and complicated logic based outputs with software capabilities that allow a proficient technician to program whatever the design engineer or owner would like controlled or monitored. Common programmable functions for fire alarm systems include: ventilation controls, door closure, security system interlocks, and suppression system activation. These control functions or output commands can readily

C-TEC will launch its first networkable analogue addressable fire panel, the XFP, at this year's International Fire Expo (16-19 May at Birmingham's NEC)



Designed to comply with EN54 parts 2/4, the panel offers a vast array of user and installer-friendly features, including:

- Full compatibility with Apollo's XP95/Discovery and Hochiki's ESP protocols
- Two independently programmable conventional sounder circuits
- Two programmable inputs
- A fault output relay and three programmable relay outputs
- A zone dependency/coincidence function
- A day/night (building occupied/unoccupied) function
- An investigation delay period function
- Individual sensitivity settings for each device
- A phased evacuation facility
- An alarm counter that records the number of times the XFP has been in an alarm state
- An intuitive Windows based upload-download PC program that allows the system to be programmed quickly and easily

Available in two different versions (single loop 16 zone and 1-2 loop 32 zone), the XFP's network protocol allows up to eight master panels (any version) to be connected together with an additional four repeaters available per master.

Fire Alarm Control Units – Changing Technology

In the U.S. market, only one manufacturer produces a fully addressable notification appliance system that is ULI Listed and capable of being programmed similar to a fully addressable SLC.

be designed to interface with building automation systems which, in turn, can control and command dampers, air handlers, and complete smoke evacuation and control systems.

The user interfaces with FACU's have advanced from light emitting diodes (LEDs) that flash or light when the system status changes to 160 character liquid crystal displays (LCDs). More recent FACU advances include flat panel touch screen interfaces that allow the user to view isometric layouts of a building and navigate through the screens by simply touching the icons using Microsoft Windows style logic from the building or zone isometric display to the specific initiation device in alarm on a system. Graphic user interfaces are also available that can be provided on desktop computers to provide full FACU functionality including the information and control of the building automation system. This graphical interface enables simultaneous monitoring of building systems and life safety.

SIGNALING LINE CIRCUITS (SLC)

Current FACU's provide signaling line circuits (SLCs) that are either analog addressable or digital addressable. Analog signals are defined as the transmission of a signal by a method of varying the shape of a waveform consisting of voltage or current variations. Digital signals are the transmission of data in streams of on and off signals or signals that set specific high values and specific low values (i.e., zeros and ones). Both the analog and digital communication methods enable rapid device polling for status and supervision. Many manufacturers have begun to migrate from analog to digital to allow for the increase in the speed of communication.

The device addressing means vary between manufacturers in two ways; some use physical switching/selecting and others use electronic programming methods with the address stored on an internal data storage component (the device is attached to a programmer and the address is electronically assigned). The fire alarm devices are assigned an address on the system (i.e., Loop 2, Detector 67). Some of the physical addressing methods include dip switches, dial indicators, magnetic storage methods, and punch tabs.

In FACU's that rely on distributed logic, the address is preset at the factory and bar-coded to identify the address. The fire alarm control unit then acquires the device address through interrogation when it is connected to the addressable loop. Data is then transmitted back and forth through the SLC allowing constant exchange of large quantities of data between the FACU and the peripheral devices.

NOTIFICATION APPLIANCE CIRCUITS

In the U.S. market, only one manufacturer produces a fully addressable notification appliance system that is ULI Listed and capable of being programmed similar to a fully addressable SLC. This addressable notification system is fairly uncommon due to the cost of equipment and the overall system limitations. In order to provide NFPA 72 and Americans with Disabilities Act (ADA) compliant notification coverage, a large number of notification appliances can be required. Large numbers of notification devices means a comparable number of conservatively loaded power supplies to provide power to operate the appliances.

European manufacturers now produce systems where every component of the fire alarm system is addressable including notification appliances (sounders and strobes). The disadvantage to this system capability is that notification appliances tend to consume all of the available addresses and power very quickly.

Another complication to notification is that all visual notification appliances must be synchronized to comply with NFPA 72 and ADA. This means that when the visual notification appliances flash, they must all flash at the same time. The industry (in most cases) has addressed this in many ways. Fire alarm control unit technology has advanced to the point where the connection of the SLC (or the panel network) directly to the remote notification power expander panels can be made allowing the technician to select synchronization in the program. Other options include synchronization modules.

CONCLUSION

From a review of current manufacturer's offerings it is easy to conclude that the fire alarm industry is experiencing controlled but reasonable growth in the application of available new technology.

Mr. Scott M. Golly, P.E is a fire protection engineer with Hughes Associates, Inc., a Fire Science & Engineering firm located in Baltimore, Maryland. Mr. Golly specializes in fire alarm, detection and special suppression systems, has experience in manufacturer specific design and has been factory trained by several panel manufacturers. Mr. Golly is an active volunteer firefighter with over 13 years of service.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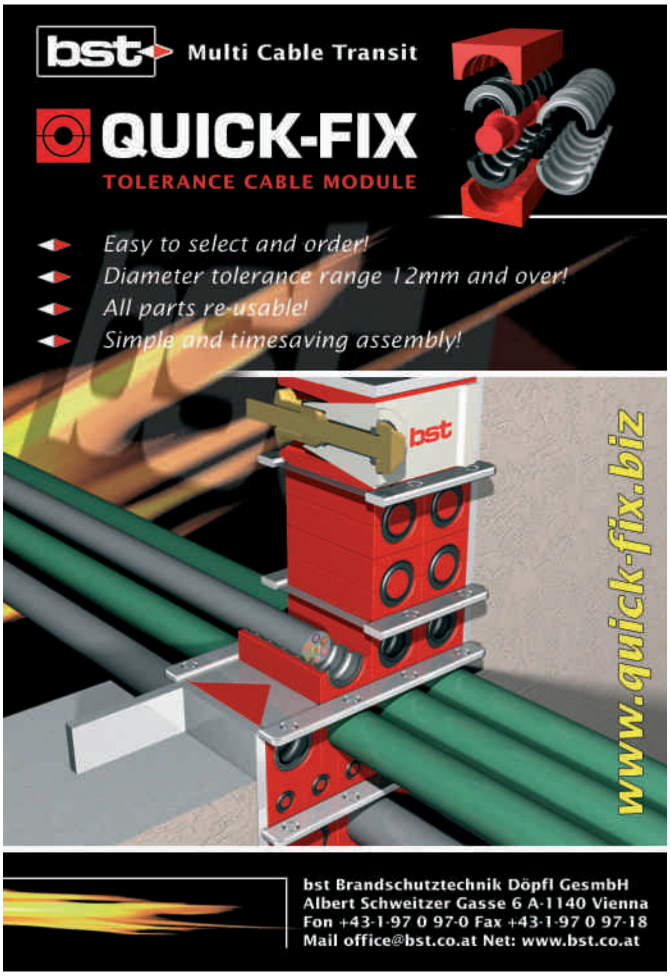
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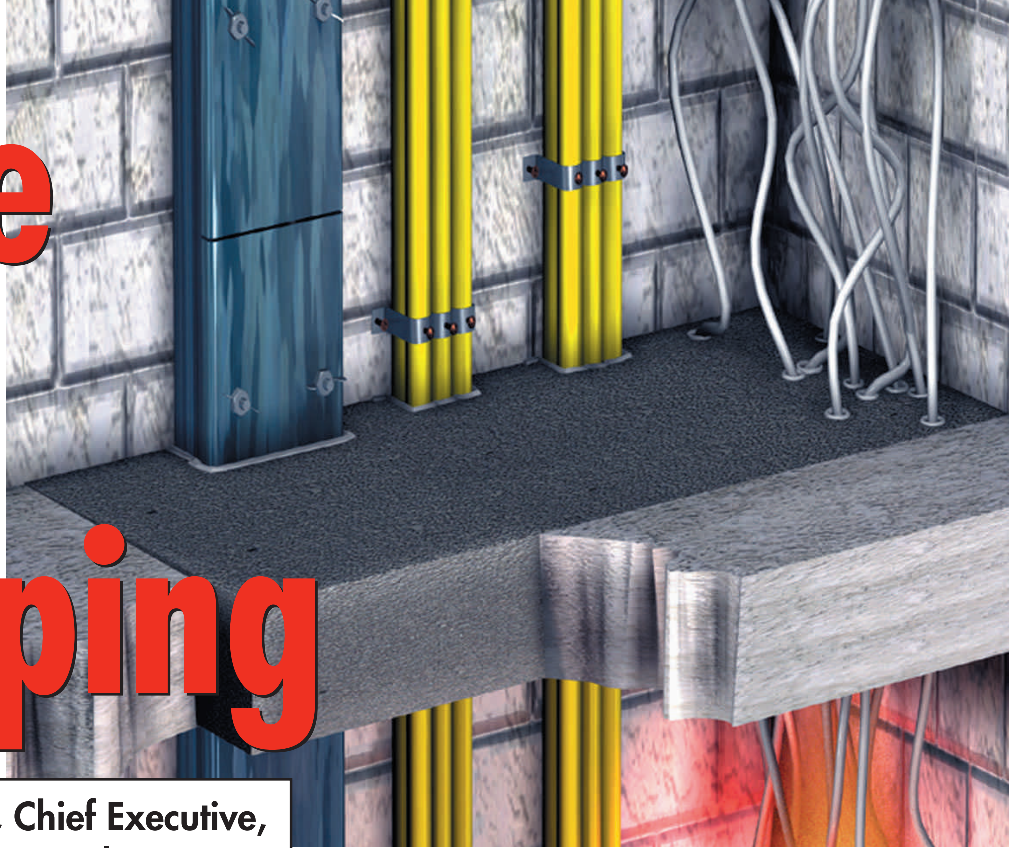


By Graham Ellicott, Chief Executive, Association for Specialist Fire Protection (ASFP)

Coated mineral wool batt, stopping the passage of fire and smoke through service penetrations.

Pic by kind permision of ASFP member Promat UK Ltd.

What are the current options?

WHERE CABLES PASS THROUGH fire compartment walls or floors there are a number of permanent ways to seal the penetration so that it has the equivalent fire performance as the wall itself. Typically cable penetration systems are tested using the furnace conditions and relevant performance criteria defined in BS 476 Part 20: 1987, or to the European standard prEN1366. The Association for Specialist Fire Protection (ASFP) recommends that all cable penetration fire sealing systems should be installed by a contractor that is a member of a trade association with an enforceable code of practice and that the contractor also be a member of a third party accreditation scheme such as FIRAS.

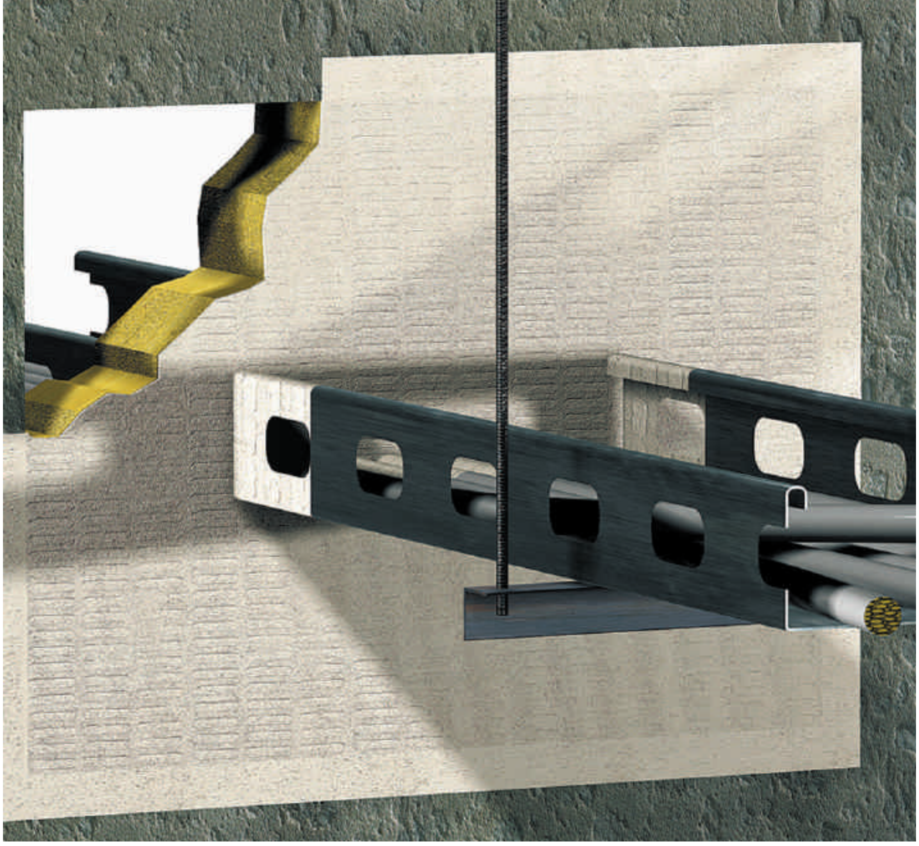
Possibly the most popular method for sealing cable penetrations utilises coated mineral fibre batts. These are supplied in a number of forms; typically referred to as mats, slabs, batts or pre-formed shapes. These products are usually manufactured from the range of higher melting point mineral wools. The usual density range is 75-250kg/m^3. The advantage that these products provide is that additional services can be readily installed as required. In certain circumstances a supporting structure will be required and the manufacturer of the product in question should be consulted for further details in this instance.

Coated mineral fibre batts can be installed as pre-formed shapes or as standard batts tailored to fit openings. Batts can be friction fitted to the sides of the opening and around the penetrating services. A 'fire resistant' sealant is generally applied to all joints and to the raw edges of the slab. Some systems may require secondary support and again this will vary from manufacturer to manufacturer. A specialist contractor should install such systems. These products generally require a minimum of maintenance during the lifetime of the building, but annual inspections are desirable to recognise any mechanical damage and to carry out the necessary repairs made. All seals must be properly reinstated when services are re-routed.

Foams can also be used to seal around cables and these are normally used for smaller penetrations. These systems are normally two component materials which, when mixed together, cause the material to foam and increase its volume. The material vulcanises at normal room temperatures resulting in the formation of a highly resilient seal. Foam systems can be expected to prevent the passage of cold smoke, halon gas and have good resistance to water, including flooding. For floors, foam seals would not be considered load bearing. Foam seals are particularly useful where access is difficult and where services are complex. They will accommodate small amounts of axial and lateral movement of the penetrating services and will achieve a degree of nuclear radiation attenuation.

Metered mixing for foams is essential and reaction times will vary. Temporary or permanent damming boards are used to contain the expanding mixture. Where permanent damming boards are used their presence must not adversely affect the fire performance of the finished seal.

Room Temperature Vulcanising Foams (R.T.V.'s) generally have a long service life. An annual visual inspection is strongly recommended to check that the seal has not deteriorated or experienced mechanical damage. It is good practice to inspect more frequently to ensure that, where a seal may have been modified for the addition of new and/or the removal of existing penetrating services, the seal has been reinstated.



Hard wearing and durable fast setting mortar which forms a permanent load bearing fire seal in walls and floors. *Pic by kind permission of ASFP member Promat UK Ltd.*

Fire resistant mortars can also be used to seal cable penetrations and these are generally composed of a gypsum or cementitious based powder blended with inorganic lightweight fillers, composite reinforcement and chemical modifiers. The compounds are designed to be mixed with water with typical densities ranging between 800kg/m^3 and 2000kg/m^3. With some systems the fillers give positive expansion whilst curing, to overcome the possibility of shrinkage cracks.

The systems are mainly used for sealing penetrations through concrete and masonry constructions, although some can be used in conjunction with lightweight partitions or timber floors. Whilst the systems are particularly useful for sealing small or complex penetrations, some are capable of being used to seal large openings.

In wall penetrations some mortar systems will be capable of supporting the penetrating services in a fire without the need for additional mechanical support. In floor penetrations many systems will be capable of supporting light loads such as maintenance foot traffic, although it is likely that some form of additional reinforcement will be necessary (i.e. weld mesh, rebar etc). Like foams, these systems can be expected to have resistance to cold smoke, halon gas and mechanical damage and may have good resistance to water, including flooding.

Mortars are mixed and applied with simple tools, generally without the need for specialist equipment. For large installations, some materials are capable of being pumped after mixing. In floor penetrations a temporary or permanent damming board is normally used with the mortar poured in place. Small penetrations can sometimes be made by trowelling the mortar into the opening without the use of a damming board. For wall penetrations, mortars are often trowelled using a single damming board or no damming board, dependent on the opening size.

> *In wall penetrations some mortar systems will be capable of supporting the penetrating services in a fire without the need for additional mechanical support.*

Mortar seals generally have a long service life; however, an annual visual inspection is strongly recommended to ensure that the seal has not deteriorated in situ. In most cases, the mortar seals may be reinstated or repaired using more of the same material, strictly in accordance with the appropriate installation method.

Single or multipack fire resistant sealants/mastics can also be used to provide a fire resistant seal around cables. These comprise organic, inorganic or intumescent fillers pre-dispersed in a suitable binder (i.e. acrylic, polysulphide, silicone etc). The materials are of high viscosity and are dispensed by gun, or trowelled into the opening and between penetrating services. The materials cure by way of evaporation or chemical reaction to give either a flexible or rigid seal, dependent upon the binder system. This type of penetration seal would normally be used for small openings with the sealant in some cases being applied onto a combustible material such as polyethylene or onto a non-combustible backing material such as mineral wool. In the latter case, this may form a part of the fire design of the seal.

Fire resistant sealants/mastics are normally installed without the need for specialist equipment and often without the need for site mixing. Use of mastic guns or trowels is common, although for floor penetrations some materials can be poured using temporary or permanent damming boards. Dusty/friable surfaces may need additional treatment prior to the application of the product. These types of seals may last for the life of the building. If, however, the seal has deteriorated or suffered mechanical damage, it should be completely removed and replaced in accordance with the manufacturer's instructions.

In summary, there is a wide range of products that can be used to provide a fire resistant seal around cable penetrations. More details are available in the ASFP publication 'Fire Stopping and Penetration Seals for the Construction Industry – Second Edition' which is available as a free download from the ASFP website www.asfp.org.uk

But remember, to ensure that the products are installed correctly it is important to use a contractor that is a member of a trade association with an enforceable code of practice and that the contractor is also a member of a third party accreditation scheme.

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Fixed Fire Fighting Foams – *Asking the right questions, making the right choices*

By Andrew Shiner

WHILE THE PETROCHEMICAL INDUSTRY is undeniably one of the major users of fixed foam fire protection systems, it is essential to have a detailed understanding of the particular installation, the risks and processes before deciding on the most appropriate solution. Here, Andrew Shiner, Director, Marketing Europe, Middle East & Africa for Tyco Fire & Security's Fire Suppression Group explores some of the issues affecting system design and overviews the merits of different fire protection strategies and the foam agents currently available.

No one would dispute that the petrochemical industry constantly faces an unrivalled fire safety challenge; the processing, storage and transportation of large quantities of highly flammable and combustible liquids. While they are infrequent, large storage tank fires are headline news and challenge all but the most professional and experienced fire fighting specialists. The cost of lost production has the potential to run into billions of dollars, and the life-threatening consequences are very real. However, risks can be minimised through the careful design of the fire protection systems, provided that this is based on a detailed and current risk assessment.

Indeed, it is an industry where the need for professionally undertaken and constantly updated risk assessment is of paramount importance. It has to address some tough questions. What is the worst possible fire scenario; what resources would be needed to fight such a blaze; what if the fixed installations are destroyed by explosion; what sort of response would the local municipal fire service provide, and how long would it take to be in place?

Certainly, the fire risk assessment should never be downgraded to the status of an occasional paperwork exercise. Risk assessment in this sector in particular must be a dynamic process and be top of the agenda, particularly when considering changes to the facilities or processes. These changes will often alter the facility's risk profiles, and this might well jeopardise the effectiveness of existing fire protection systems that, by their very nature, must be risk specific.

And it must be remembered that, in the UK for example, the Regulatory Reform (Fire Safety) Order of the Fire Services Act, which is planned to come into effect this year, places a whole new area of fire safety responsibility directly on the facility manager's shoulders. Under the Order, the onus for carrying out fire safety assessments passes from the local municipal fire brigade to the premises manager, who will have the legal obligation to ensure that competent people – either employees or sub-contract specialists – undertake fire risk assessments of their facilities.

TAKING THE HOLISTIC APPROACH TO PETROCHEMICAL FIRE SAFETY

While outside the scope of this article, it is important to recognise that, in addition to commissioning a well-conceived fire fighting system, risks can be minimised by adhering to appropriate design guidelines at the facility's construction stage. For example, well designed and built storage tanks that are correctly installed and well maintained are essential; so too is the proper use of containment techniques and the adoption of passive fire protection measures.

This care and attention to fire safety detail applies to refineries and processing

Fixed Fire Fighting Foams

areas; flammable and combustible liquid storage areas, including tanks and warehousing; bund and dike areas; vehicle loading facilities and jetties. Inevitably, such a diverse collection of fire risks calls for a comprehensive toolbox of products; foam agents and design expertise to create an optimum fire protection solution for the entire facility.

The design of fire protection systems requires specific expertise and experience in identifying the risks associated with hazardous materials and processes. Each application may well warrant a different fire protection solution, depending on the type of liquid stored or processed. So, the system's designer must consider the liquid's flash point, its boiling point, and determine if it is a hydrocarbon or a water-soluble, polar solvent fuel. This information enables the designer to complete the first part of the design process, classify the liquid, and establishes the most appropriate type of foam concentrate, its application rate and the discharge time.

To assist the designer, the NFPA [National Fire Protection Association] has developed a taxonomy for flammable and combustible liquids, which assists in developing appropriate fire protection tactics. For example, volatile liquids have a high vapour pressure and are easy to ignite, while products with a high vapour pressure and low flash point are more difficult to extinguish than products with a low vapour pressure and high flash point.

FIRE FIGHTING FOAM OPTIONS

There have, in recent years, been many advances in the field of foam concentrates, and some suppliers have been somewhat over enthusiastic when promoting their own type of generic product, the formulation of which has been dependent upon the company's manufacturing capability. However, it is important to be aware of the wide range of foams that are available today, from low cost but highly stable protein foams through to the latest leading-edge synthetic products, such as the Tyco Fire and Suppression's Thunderstorm 1 x 3, which was developed in consultation with Williams Fire and Hazard Control Inc, probably the world's most highly respected specialist in the fire protection of flammable liquids.

Basically, foam is a stable mass of small, air-filled bubbles that have a lower density than oil, petrol, or water. When it is discharged, it comprises three elements; the foam concentrate, water and air. Because of the product's low density, it readily floats on a fuel's surface to extinguish a flammable liquid fire by separating the fuel from oxygen. Effectively, it smothers the fire, while its high water content provides effective cooling. Well-formulated foam, correctly applied, will exhibit a number of characteristics. These include stability, cohesion, rapid fire-knockdown, heat resistance and vapour suppression; all of which will ensure that a fire is extinguished efficiently and securely to prevent reignition.

Briefly, the types of foam currently on the market can be summarised as follows:

■ ***Protein Foams:***

Stable mechanical foam.
Good expansion properties.
Excellent heat and burn-back resistance.
High fluidity.
Low fuel tolerance.

■ ***Fluoroprotein Foams:***

Inherent stability of protein base.
Faster flame knock-down.
Fuel tolerance.
Greater fluidity.
Hydrocarbon vapour suppression.

■ ***Aqueous Film Forming Foams (AFFF):***

High quality foam.
Low or medium expansion.
Compatible with wide range of equipment.
Good shelf life.
Concentrated agents available for 1% induction.

■ ***Film Forming Fluoroprotein Foams:***

High stability foam.
Rapid knock-down.

■ ***Alcohol Resistant Concentrates:***

Synthetic or fluoroprotein.
Highly versatile.
Fast knock-down.
Good burn-back resistance.
Fuel tolerant (used on hydrocarbon and polar solvents).
Excellent prolonged vapour-mitigating properties.

Of course, it is not merely a matter of selecting the foam, critically important though that is; it is equally essential to decide on a supplier of foam concentrate and provider of delivery systems. And this must be a decision that is not based on cost alone! Continuity of supply, technical support, engineering know-how, manufacturing resources and industry expertise all have to be assessed.

PETROCHEMICAL INDUSTRY APPLICATIONS

The petrochemical industry uses a variety of storage tanks for its products, each with a slightly different risk profile:

- Cone roof tanks (fixed roof tanks).
- Open-top floating roof tanks.
- Covered floating roof tanks.
- Horizontal tanks.

Usually, the primary protection of tanks is by means of fixed fire protection systems, with secondary protection being achieved through the use of foam monitors. Foam generators used in fixed systems have proved very successful in many installations and can provide a cost effective and reliable solution. However, any damage to the tank structure may well limit the foam generator's efficacy. This, together with

Fixed Fire Fighting Foams

maintenance issues, has lead to the widespread use of sub-surface injection systems, where sufficient water pressure is available for their use.

Sub-surface injection of foam into a storage tank is, as the name implies, where the foam is injected into the bottom of a tank, and then floats to the surface to spread and extinguish a fire. However, this method is unsuitable for use with polar solvents, even where alcohol-resistant concentrates are used, because the fuel destroys the foam. So extreme care must be taken to ensure that the sub-surface injection technique is not used on potential gasoline blends that contain alcohol or other polar solvent additives as oxygenates.

Sub-surface injection also cannot be used on cone roof tanks with internal floaters, in accordance with NFPA 11 – standard for low, medium and high-expansion foams. To overcome this problem, the so-called semi-subsurface injection technique has all of the benefits of sub- surface injection, and can be used for all types of fuel. The semi-subsurface technique uses a flexible hose, which floats to the surface when the system is activated, to deliver the foam to the surface.

Fixed monitors are a cost effective method of protecting relatively small storage tanks and associated spill or ground fires. Remote operation, which ensures that fire fighters are kept at a safe distance from the incident, can be achieved by using electrical or hydraulic control systems. Although monitor's streams have successfully been used for extinguishing fires in larger diameter tanks, using high-flow devices and large diameter fire hoses, monitors should not – in accordance with NFPA 11 – be considered as primary protection for larger cone roof tanks with diameters in excess 18 metres.

Fixed systems can also be used for floating roof tanks; foam pourers are used to protect the rim seal area, with the foam being contained by a dam. However, good foam fluidity is essential to ensure that rapid coverage is achieved, and some oil companies have adopted a belt-and-braces approach and installed both foam pourers and sub-surface systems on covered floating roof tanks.

Horizontal tanks have been known to rupture following an explosion, so it is necessary to ensure that the bund area is adequately protected. Fixed low or medium expansion generators can be used to create an effective foam blanket, even on larger bund areas in major tank farms, and any residual fuel in the tank can be protected using a monitor. In reality, monitors can be used to protect the bund area, but this results in much higher foam consumption. At least two monitors are recommended to protect larger bunds to ensure full coverage and access to devices under all wind conditions.

Truck loading racks require special attention as a fire in this situation can escalate and threaten lives. Foam can provide a quick knock-down with the added advantage of vapour suppression and containment to prevent reignition prior to the cleaning-up process. Foam is delivered through a combination of an overhead foam/water deluge sprinklers supplemented by low-level ground sweep nozzles. Additional protection is provided against radiant heat, and structural cooling is beneficial to prevent further damage. Monitors can provide cost effective protection, but coverage remains an issue and the designer must be certain that this strategy will deliver the site's fire protection objectives.

Sub-surface injection also cannot be used on cone roof tanks with internal floaters, in accordance with NFPA 11 – standard for low, medium and high-expansion foams.

Andrew Shiner is Director, Marketing Europe, Middle East & Africa for Tyco Fire and Security's Fire Suppression Group. He has worked in the fire safety industry for the past 15 years and has extensive international experience. Andrew has an MBA, a post graduate Diploma in Marketing, and is a Chartered Marketer.

Emergency Eva
Systems for '

IN TODAY'S EVER CHANGING WORLD one of the hottest topics is how to move people in an emergency swiftly and safely to a safe haven.

Directional sound technology offers a solution to improve the exit or escape situation for building occupants by providing an additional stimulus in the form of sound cues that draw attention to otherwise ignored egress routes and exit locations.

By John Fennah

Directional sounders, when integrated with the emergency lighting and fire alarm system in a building, are an audible and supplemental means of identifying exits and egress routes. These units provide a means of overcoming the limitations of current signage and alarm signals.

"Voice evacuation" has been at the forefront in people movement in the U.S.A. for years, with Europe now moving quickly in pursuit, but the World Trade Centre collapse has changed that perspective. Pre-recorded messages may not provide for all eventualities and live broadcasts of real time scenarios have been found to be less than adequate. In fact the World Trade Centre showed how people will still make up their own minds in what they believe is the best course of action, even though they have been provided with auditory advice.

Standard fire alarm systems designed to initiate evacuation use audible and visible notification appliances. Depending on the particular fire emergency plan, the occupants may be required to evacuate immediately or prepare for such evacuation. Often, occupants may not be familiar with the building and its associated emergency egress routes and may have to rely on exit maps, markings or signage to guide them to an exit, refuge area or other means of egress. The traditional maps, markings and signage required by code provide occupants a visible means for locating or finding a path to safety. Generally, exit signage will be the primary means for locating an exit. If an emergency plan has been prepared, it may include diagrams showing the locations and routes to exits. Occupants, however, may not have had the opportunity to study and understand such a diagram or may be unable to visualize an actual escape route as depicted on such a diagram.

There are other limitations to the way building occupants identify the means to reach a point of safety in a building during a fire or other emergency that necessitates evacuation. Persons with visual disabilities will have difficulties with emergency information that relies on visual cues. The signals that alert the occupants to an emergency event usually are both audible and visual, but they give no clue as to which way to proceed to reach an exit. Illuminated exit signs serve only as a visual cue and may be of no assistance if the lamps are faulty. Another weakness is that the illuminated front of an exit sign often competes with nearby bright lights or other visually distracting elements (airport terminals are a good example of too much "visual clutter"). Exit signs may be inadvertently blocked from view due to renovations or remodelling of building spaces.

Persons with visual disabilities will have difficulties with emergency information that relies on visual cues.

Of course, at the time of a fire, when exit signs are most needed, smoke can obscure exit signs and the location of exit doors. A myth associated with fire scenarios is that fire detection systems are now so advanced that people do not need to travel through smoke to reach safety. Research at the University of Maryland that studied survivors from 400 different fires, showed that 53% of survivors from fires reported travelling through smoke. If it is accepted that people may have to, and will, enter smoke in order to escape a fire situation, then it is imperative that information supplemental to visual signage is provided. However, the combination of the exit sign and the directional sound has been shown to be the most reassuring to the evacuating public by providing comfort when reaching a door on the exit route and finding a visual cue.

HUMAN BEHAVIOR

Experts in the field of human behaviour have recognized two phenomena that appear common in evacuation situations. First, occupants tend to exit a building by the route familiar to them, which may be the same route they used to enter the building. Second is the concept of "learned irrelevance" of exit signs, where people continually exposed to exit signage seldom consider the information it is intended to convey, i.e. the identification of alternative exits and exit access. In an emergency, they

cuation Sound 'Wayfinding'

Pic courtesy of Emergi-Lite Safety Systems

fail to respond to signage pointing to alternate means of egress, instead opting for the exits with which they are familiar, as in the Rhode Island nightclub disaster pictured.

Directional sound offers a means for reducing these tendencies by providing an additional stimulus in the form of sound cues that draw attention to otherwise ignored egress routes and exit locations. In this way, directional sound can serve to increase exit utilization by encouraging the use of all exit facilities and speeding total evacuation when needed.

The broadband pulses emitted by directional sounders make use of our natural ability to localize sound sources when provided with the appropriate spectral and temporal cues. The brain is designed to pinpoint sound very accurately, as a basic survival pre-requisite. We hear sounds over a huge frequency range of about 20Hz to 20,000Hz, although this range diminishes as we age. Only certain types of sound are easy to localize and the crucial component is that they contain a large spectrum of frequencies – i.e. broadband sound. With broadband sound, the brain has the maximum number of cues available to process, and is thus termed "directional sound".

Over ten years of research in a range of environments (including buildings, aircraft, ships and tunnels) has shown the effectiveness of directional sound technology. The research has been undertaken by a range of academic institutions in the United Kingdom, including the Universities of Leeds, Greenwich, Cranfield and Strathclyde, using participants aged between 17 and 67 years old, with visual and auditory impairment consistent with an average population. Numerous research studies have shown that directional sounders improve the flow of people towards exits, and they improve evacuation efficiency.

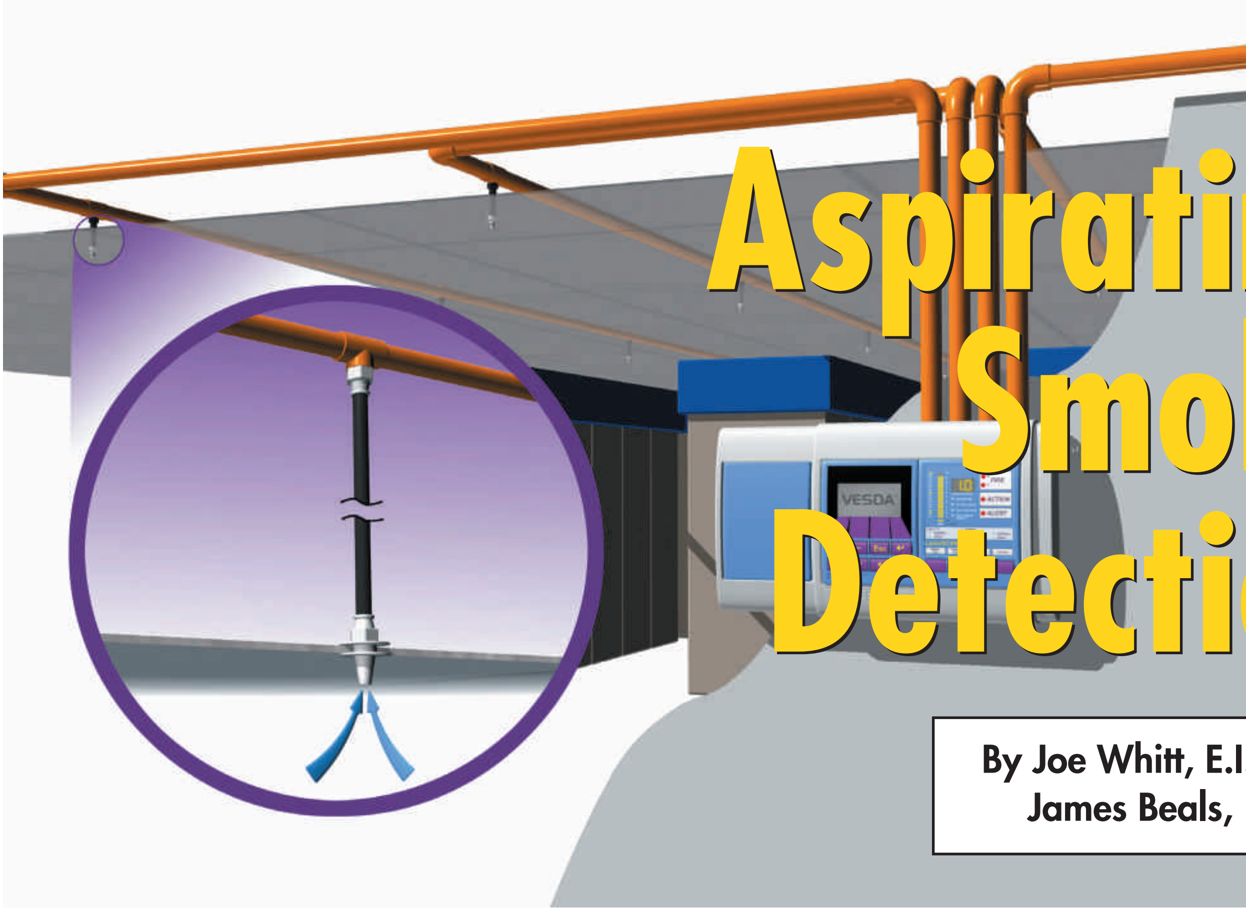
In a smoke or fume filled environment, the use of directional sounders can reduce evacuation time by up to 75 percent. Even when there is no smoke; directional sounders can cut evacuation time by 35 percent. However, directional sounders are something new. Just like people had to learn that red means "stop" and green means "go," it will be necessary for people in buildings to learn what the signals mean. Training and education will increase the effectiveness of directional sound installations.

TWO DISTINCT INSTALLATIONS

There are two ways to install directional sounders. A basic installation calls for directional sound devices at the location of code-required exits and areas of refuge. The intent is to place a directional sound device in close proximity to the door of each exit or area of refuge as an audible cue for locating it in an emergency. The concern is not for establishing an audible signal in all occupied building spaces, rather the focus is to provide sound cues to assist occupants in more easily locating the point of entry to an exit or area of refuge under adverse conditions.

For an enhanced installation, in addition to the sounders needed for a basic installation, there are also directional sounder devices that give audible directional cues along the means of egress, thereby guiding the person towards the exit or area of refuge. The directional sounder emits a broadband, multi-frequency sound and is capable of being set to multiple pulse patterns, each consisting of pulses of broadband sound. The patterns are used to provide distinctive sound cues at an exit or along a route to the nearest exit. The pulse patterns can be set to signify increasing proximity to an exit, the fastest pulse being used at the exit. Other audible information can supplement the pulsing broadband sound as guidance for special situations. For example, each pulse pattern is capable of being supplemented with other audible cues, such as a warning to alert occupants that they are approaching a stairway and need to proceed either up or down.

John Fennah is a technical consultant in sound egress systems working in association with Emergi-Lite Safety Systems. He has 20 years' experience in the industry, having worked for companies such as Hakuto International, Notifier, Vimpex and Sound Alert.



Aspirating Smoke Detection

By Joe Whitt, E.I.T and James Beals, P.E.

This is a simplified typical piping arrangement showing a 4-zone VESDA® system and the collection tubing. *Pic courtesy of Vesda Systems Inc.*

INCIPIENT SMOKE DETECTION HAS developed into a premier commodity for several industries. From facilities with high-end electronics and server farms to museums containing irreplaceable objects and places of worship, aspirating smoke detectors and other early detection products are designed to detect the byproducts of a fire in the earliest stages of growth. Early detection is essential to the protection of mission critical assets.

The data processing and, more recently, telecommunications industry has always had the need for specialized fire suppression and detection systems. Until the application of the Montreal and Tokyo Protocols limiting the use and production of Ozone Depleting Products (ODP), Halogenated Fluorocarbon (Halon) fire fighting agents were widely used in data and telecommunications areas. They could be deployed through the use of standard smoke detectors to extinguish fires with little or no damage to the electronic equipment, historic documents and other sensitive equipment or materials.

There has always been a concern that the treatment was more damaging than the problem when associated with the application of water based suppression systems onto electronic equipment or historic documents. Some of the gaseous based Halon replacement agents can also cause damage due to the production of various acids as a byproduct of the fire suppression chemical reaction.

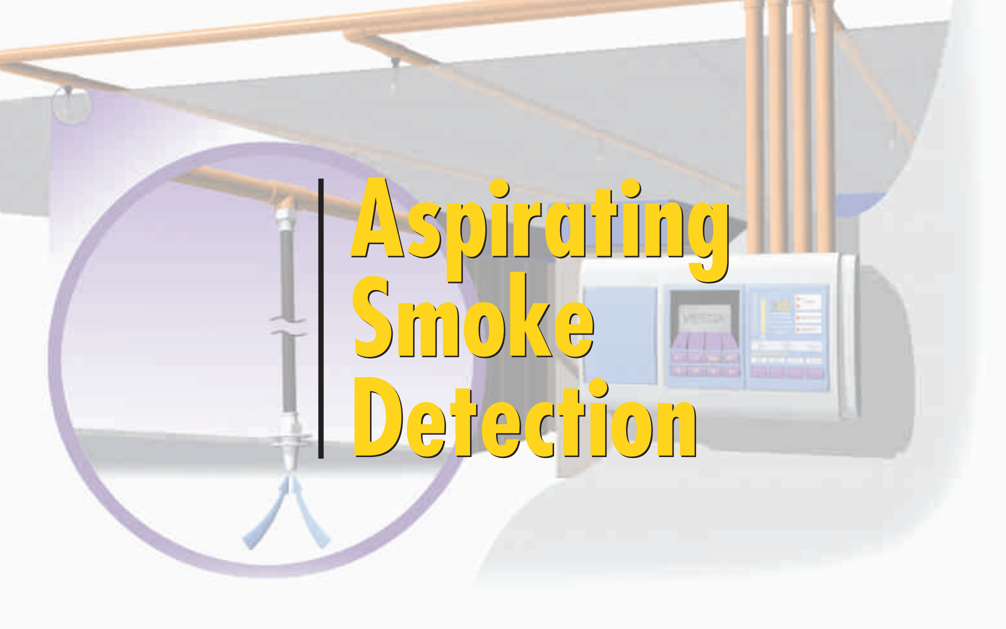
For these reasons, and others, the need for incipient fire detection has grown. Detecting a fire very early in its growth allows on-site staff to investigate and possibly extinguish the fire prior to the need for any application of a large scale suppression system such as fire sprinklers or gaseous agents.

In this article, we will discuss the history of incipient smoke detection and the advances that are being made today. Then, we will discuss its present technology and application.

> *Detecting a fire very early in its growth allows on-site staff to investigate and possibly extinguish the fire prior to the need for any application of a large scale suppression system such as fire sprinklers or gaseous agents.*

HISTORY

As reported by Vision Systems, the manufacturer of the VESDA® (Very Early Smoke Detection Apparatus) system line of products, the original technology which became the aspirated smoke detection systems in use today started out life as a device for measuring pollutants and other products of



Aspirating Smoke Detection

combustion caused by forest fires.

In the 1970's, the Australian Post Office hired the Commonwealth Scientific & Industrial Research Organization (CSIRO) to investigate into technologies that cold prevent telephonic and electronic data transfer service interruption due to fire. The need was for a fire or smoke detection system which would detect a fire early to allow for effective suppression and well before the fire and its associated products of combustion could cause significant amounts of damage.

The testing of the available "standard" available smoke detectors did not yield the hoped for early detection results. As is frequently the case in research and development however, an unforeseen development led to an effective solution. The smoke detector test complex included the installation of nephelometers (optical air-pollution monitor, similar to those used for the airborne pollution monitoring) in the return air ducts to gather information on the products of combustion as part of the device testing.

The testing of the "spot" style commercially available smoke detectors indicated that detection of fires within the test center, and by extension from within telecommunication equipment rooms, was not fast enough to meet the goal of incipient detection. The detection technology available at that time operated well into the fast flaming stage, far too late.

The nepholometer technology did detect the products of combustion from fires in the incipient stage. Reportedly, the available sensitivity was found to be approximately 0.1% obscuration per meter. With adjustments and additional testing it was presumed that the sensitivity could be fine tuned to allow this style of detector to be hundreds of times greater than that of the most sensitive commercial smoke detector then available.

The aspirating style of smoke detector was born.

Initial development of the aspirating style detection systems was not without a significant expense and lack of coordination. Suffice to say that eventually a commercially marketable product was developed by IEI Pty Ltd of Australia.

The most significant recent modification to the aspirating style of incipient fire detection products is the use of laser technologies in the detection chamber, replacing the original Xenon flash tube light sources.

IEI redesigned the entire system in 1982, incorporating numerous patented inventions. The product was then marketed under the VESDA® brand name. By 1995, over 30,000 systems were in use worldwide.

The most significant recent modification to the aspirating style of incipient fire detection products is the use of laser technologies in the detection chamber, replacing the original Xenon flash tube light sources.

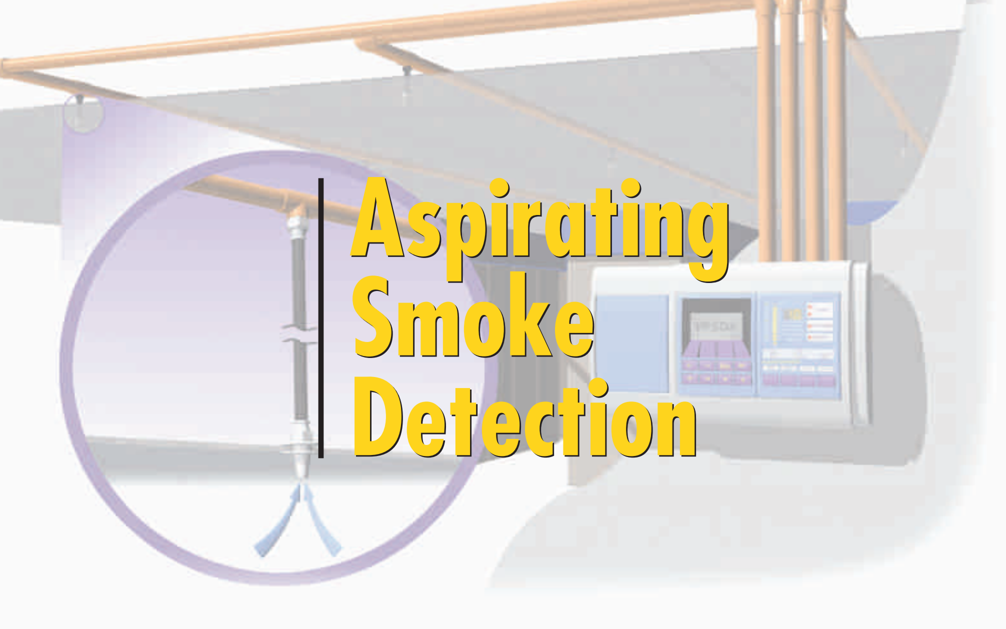
TECHNOLOGY

There are three types of incipient smoke detection on the market. They are aspirating smoke detectors, light scattering smoke detectors, and particle counters.

In an aspirating smoke detection system, there are three major components: the sampling tubes, the light chamber, and the control module. In essence, air is continuously drawn into the light chamber through the sampling tubes. While in the light chamber, the air is exposed to high intensity light. The light is then transmitted to a photoelectric receiver which is sensitive to any change in the high intensity light. Finally, a signal testifying to the status of the air sample is then sent to the control panel.

Light scattering smoke detectors also draw air samples into an optical chamber, but its chamber measures differences in the way light is scattered in the chamber. In pure air, light scatters very little. However, when a larger concentration of small particles is present, light scatter is increased. In this way, the level of smoke density may be derived.

Particle counters do exactly that, they count the number of smoke particles in the chamber. Air is drawn into a chamber where a laser is pointing. As particles pass into the path of the laser, the laser senses both light scattering and the time it takes for the particle to pass. The description of each particle is then fed to a processor for analysis. Particles that are below a certain size and of a certain shape, as determined by a programmer, are counted as a smoke particle. This method is



Aspirating Smoke Detection

dependant on a predetermined air flow rate and smoke particle size.

APPLICATION

As previously stated, the application for incipient smoke detectors is expanding. However, this type of protection is only practical for mission-critical areas. In other words, and generally speaking, an incipient smoke detection system should only be implemented if the objects to be protected have one of these traits:

- If the object(s) protected fails, an operation or set of operations would incur downtime while the situation is being corrected and until the equipment can be replaced
- If the object(s) protected is too valuable to loss or is irreplaceable
- If other means of detection have proven ineffective

Both VESDA® and Safe Fire Detection® boast a list of applications including computer rooms, data centers, air handling units, libraries, museums, places of worship, and other historical structures, MRI facilities, anechoic chambers, clean rooms, and cold storage.

Part of the allure to incipient smoke detectors is the advantages they have over conventional smoke detectors. For electronic equipment and other associated applications, incipient smoke detectors have dramatically increased sensitivity compared to conventional detectors; literally one thousand times as sensitive. Quantitatively, an aspirating smoke detector can detect smoke obscuration from 0.008% to 20.00%; a laser system can detect smoke particles as small as 0.002 microns (or approximately 1/78 millionth of an inch). Additionally, in aspirating smoke detectors, the sampling tubes may be placed in a variety of different locations and elevations to draw air to the same chamber.

The sampling tubes are convenient in and of themselves. They are easily concealable and can be as small as ¼ inch or 6 mm. Air sampling tubes can be concealed in just about any space created for it. Generally speaking they can be of any pipe or tubing material that can be made airtight with respect to the system vacuum pressures. They may be attached to light fixtures or may even be flush with a wall or ceiling. This feature has particular advantages for historical buildings or in any facility where appearance is priority.

The detection network consists of tubing located in such a way as to provide detection sampling locations as required for the particular brand and model of detector. Typically this is accomplished by utilizing PVC or CPVC plastic tubing with glued joints and fittings. The detection ports may be installed using pre-engineered sampling fittings, or may simply be ports made by drilling holes of the required diameter into the air sampling network tube.

The sampling tubes also allow for a large coverage area. Conventional smoke detectors typically have a coverage area of approximately 1,400 ft^2. Aspirating smoke detectors can have a coverage area of up to about 20,000 ft^2. This drastically limits the number of detectors required which in turn leads to reduced maintenance costs. A typical installation of the aspirating detection ports is to locate them across the return air or air exhaust grills in telecommunication or data processing rooms. The "closed' HVAC system will move the air in the protected space past the detection ports as it exhausts from the space. This is a very effective installation, provided that the air handling system is in continuous operation.

Maintenance, especially for high ceiling spaces, is reduced by having service done primarily from a remote location at the control module on the ground and not at the ceiling level.

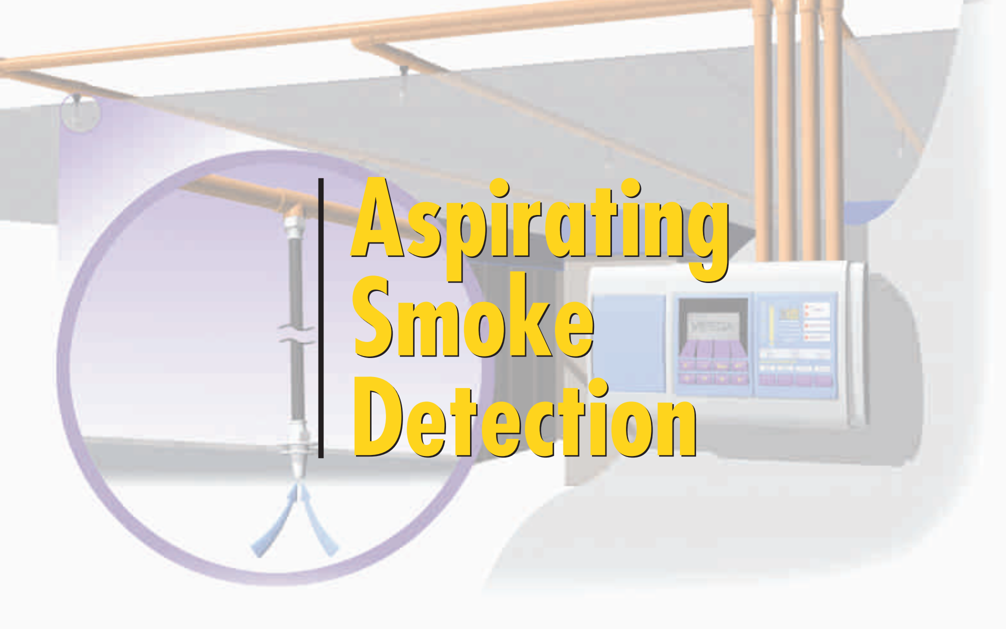
CONSIDERATIONS

Along with the benefits to each type of incipient smoke detection system, there are a few installation considerations which must be considered and evaluated.

Design and Installation

Although the technology is extremely sophisticated, like most detection systems the installation is relatively simple. However, the actual design requirements, as required by the system manufacturer must be addressed. The layout (design) of the collection ports and associated tubing should be

For electronic equipment and other associated applications, incipient smoke detectors have dramatically increased sensitivity compared to conventional detectors; literally one thousand times as sensitive.



Aspirating Smoke Detection

performed by fully qualified individuals. Fire detection system installation is typically performed by electrical contractors. Aspirating detection systems include installation requirements more related to the plumbing trades. The installing contractor must have personnel capable of furnishing quality pipe fitting techniques. All too often this aspect of the design-installation-testing-maintenance circle is not addressed until a problem makes itself apparent.

Dust

With most air sampling systems, the issue of dust collection may pose as a problem. In aspirating systems, if dust accumulation is great enough, sampling tubes could become blocked altogether. Some detection systems, like the Stratos Laser® from Safe Fire Detection®, use specialized software to differentiate between dust particles. Moreover, dust filtrations systems may also be employed though must be adequately maintained and cleaned. However, in buildings and spaces where pedestrian traffic is significant, such as libraries, museums, and historic landmarks, dust will inevitably be a part of the environment.

Each particular brand of aspirating smoke detection systems has a regular maintenance and cleaning protocol which must be followed. They are all slightly different, and are extremely critical to assure successful system operations. The collection systems must be kept clean; the sampling ports or collection heads must be clean and unobstructed; the tube collection network must be checked and flushed periodically to maintain proper air flows, and the air filters must be checked and replaced as necessary. The detection chamber components must be checked, cleaned and calibrated regularly.

Dilution

One consideration to the aspirating smoke detection system is the potential for a diluted effect to any smoke drawn by a single sampling tube. This is because the sampling tubes draw the air and collectively, and continuously, dump the air together into the light chamber, thus diluting the density of smoke. For example, if a system were to have ten sampling tubes and only one tube was drawing smoke, when the sample is dumped into the air chamber, it would effectively be one tenth as dense and possibly below the sensitivity level of the detector. In turn, this would slow down response time.

The detection system alarm threshold algorithms take these variables into consideration. They are only as effective as the design and installation conforms to the manufacturer's requirements, back again to the use of qualified design and installation personnel.

CONCLUSION

The proper application of aspirating smoke detection systems to detect and alarm for fire in the incipient stage is a tremendous tool in the fire protection toolkit. In some instances it can provide an effective replacement to fire suppression systems where the cure is as undesirable as the disease. In others, it supplements the suppression systems, giving time to responding personnel so that they may mitigate the need for automatic suppression.

Effective design, installation, testing and maintenance is probably more critical in aspirating smoke detection systems than any other type of fire detection system. However, if done correctly, the benefits far outweigh the headaches.

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ACKNOWLEDGEMENT

The assistance of Ms. Cathy Tabor of Vision Systems, Inc. was invaluable in collecting the background for the early aspirating smoke detection development. We are grateful for her help.

Mr. James Beals is the Design & Construction Manager for Rolf Jensen & Associates, Inc. (RJA). Located in their Washington, DC area office, Mr. Beals has extensive background in fire suppression and alarm systems applications. Mr. Joseph Whitt is an Associate in the Washington, D.C. area office and has experience in code review, drawing review, fire protection evaluations, and fire alarm and suppression system design. To learn more about RJA, visit their website at www.rjainc.com

Introducing the
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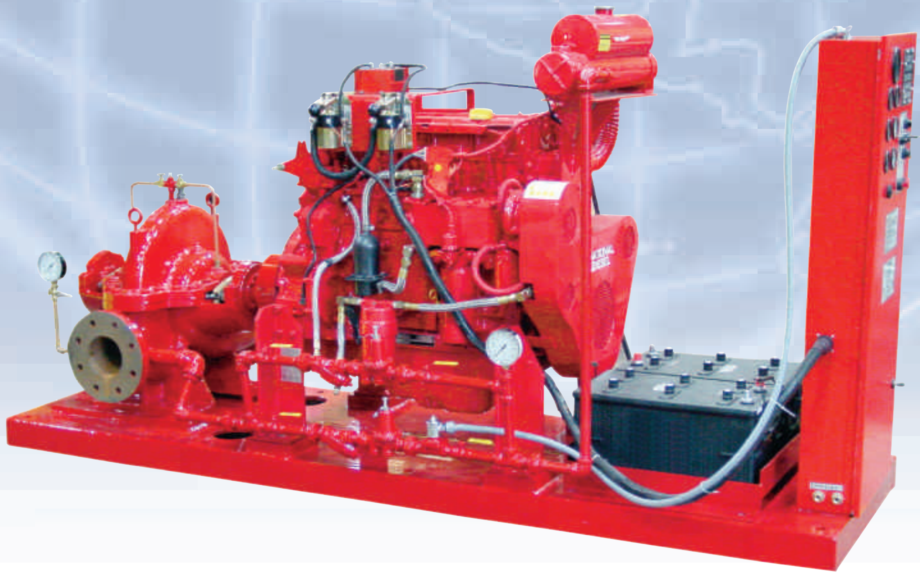
New Combination Saves Space, Time & Material



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As a combination diesel engine/ fire pump controller, the Patterson Engine Package (P.E.P.) greatly reduces the overall size and complexity of usual engine and pump controller setups.

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INTERSCHUTZ 2005 Preview

INTERSCHUTZ
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INTERNATIONAL TRADE FAIR FOR RESCUE SERVICES, FIRE PREVENTION, DISASTER RELIEF, SAFETY AND SECURITY
HANNOVER 6–11 JUNE 2005

Things are looking good for INTERSCHUTZ and INTERPOLICE 2005. Two months ahead of the start of the "International Exhibition for Rescue, Fire Prevention, Disaster Relief, Safety and Security" (6 – 11 June) at the Hannover Exhibition Center, more than 1,000 exhibitors from around the world have already booked their space at the shows. This year sees debut presentations by leading companies from Sweden, Spain, Portugal and Poland. The exhibiting firms, institutions, organizations, trade associations and other professional bodies will be staging their displays in Halls 12, 13, 26 and 27 as well as on the open-air site. Some 130,000 visitors are expected to attend.

The line-up for 2005 is once again a unique mix of exhibition, forums, special presentations and live events. Featured for the first time are four "Theme Days", where the focus is on security in the home, at work, at airports and on roads and railways.

At INTERSCHUTZ, which takes place once every five years, the industry will be showing the latest technologies, trends and services for protection and prevention, rescue work, contingency planning and organization. State-of-the-art technical aids, monitoring and surveillance systems and communications equipment complete the picture.

Strong showing from China and Russia

The exhibitor recruitment campaign carried out by Deutsche Messe AG at last October's "China Fire" trade show in Beijing has borne fruit in abundance. Around 30 Chinese firms, mainly manufacturers of fire extinguishers and extinguishing agents, have already booked stand space (as compared with only six firms in 2000). And for the first time the China Fire Protection Association (CFPA) is represented at INTERSCHUTZ with a large information stand in Hall 27.

The Russian Federation will present its latest developments for disaster relief in the form of two national pavilions (in Halls 26 and 27). Featured items include the use of robots and aircraft to combat forest fires and environmental damage, the prevention and clean-up of disaster damage, emergency rescue and the training of specialists in risk analysis and risk management. New technologies for fire prevention in high-rise buildings, civil engineering structures and multi-purpose buildings complete the program.

In addition to China and Russia, other countries that have booked space for national displays are Finland, France, Sweden, Poland, Spain and the USA.

International conventions

The industry's flagship trade fair is also the perfect setting for international conferences. So the Hannover Exhibition Grounds will simultaneously host the World Fire Services Conference and the FEU convention (Federation of EU Fire Officers' Associations).

For more information visit www.interschutz.de

www.interschutz.de

Open-air site
Vehicles and vehicle equipment
Fire extinguishers, sprinkler systems and extinguishing agents
Rescue services/equipment and environmental protection
First-aid and medical equipment
Personal protective gear and identification
Professional associations/organizations

Hall 12
Vehicles and vehicle equipment
Model making

Hall 13
Fire extinguishers, sprinkler systems and extinguishing agents
Fire station and workshop equipment
Building design and construction, structural fire protection and safety
Professional associations/organizations, service providers

Hall 26
Technical assistance and environmental protection
First-aid and medical equipment
Professional associations/organizations
Personal protective gear

Hall 27
Personal protective gear and identification
Control room and communications equipment
Data processing and administrative equipment
Professional associations/organizations, service providers
Commercial security services

Hall 27
INTERPOLICE
International Exhibition
for Police and Internal Security

Demonstration site

Convention Center
DEUTSCHER PRÄVENTIONSTAG
GERMAN PREVENTION CONGRESS
6 – 7 June

Selected Exhibitors

Amerex
www.amerexfire.co.uk
Hall 13, Stand G10

Angus Fire
www.angusfire.co.uk
Hall 13, Stand C28

AQUASYS Technik Deutschland
www.aquasys.at
Hall 13, Stand D63

AVK International
www.avkvalves.com
Hall 13, Stand E58

AVK Mittelmann Armaturen
www.avkvalves.com
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BAVARIA Brandschutz Industrie
www.bavaria-brandschutz.de
Hall 13, Stand C40

Bavaria Egypt
www.bavaria.com.eg
Hall 13, Stand C40

bst-Brandschutztechnik D^pfl
www.bst.co.at
Hall 13, Stand C74

BW Technologies
www.gasmonitors.com
Hall 27, Stand G16

Chemguard
www.chemguard.com
Hall 27, Stand K23 (28)

Danfoss Esco
www.danfoss.com
Hall 13, Stand A31

Eusebi Impianti
www.eusebigroup.com
Hall 13, Stand A50

Fire Fighting Enterprises
www.ffeuk.com
Hall 27, Stand H58

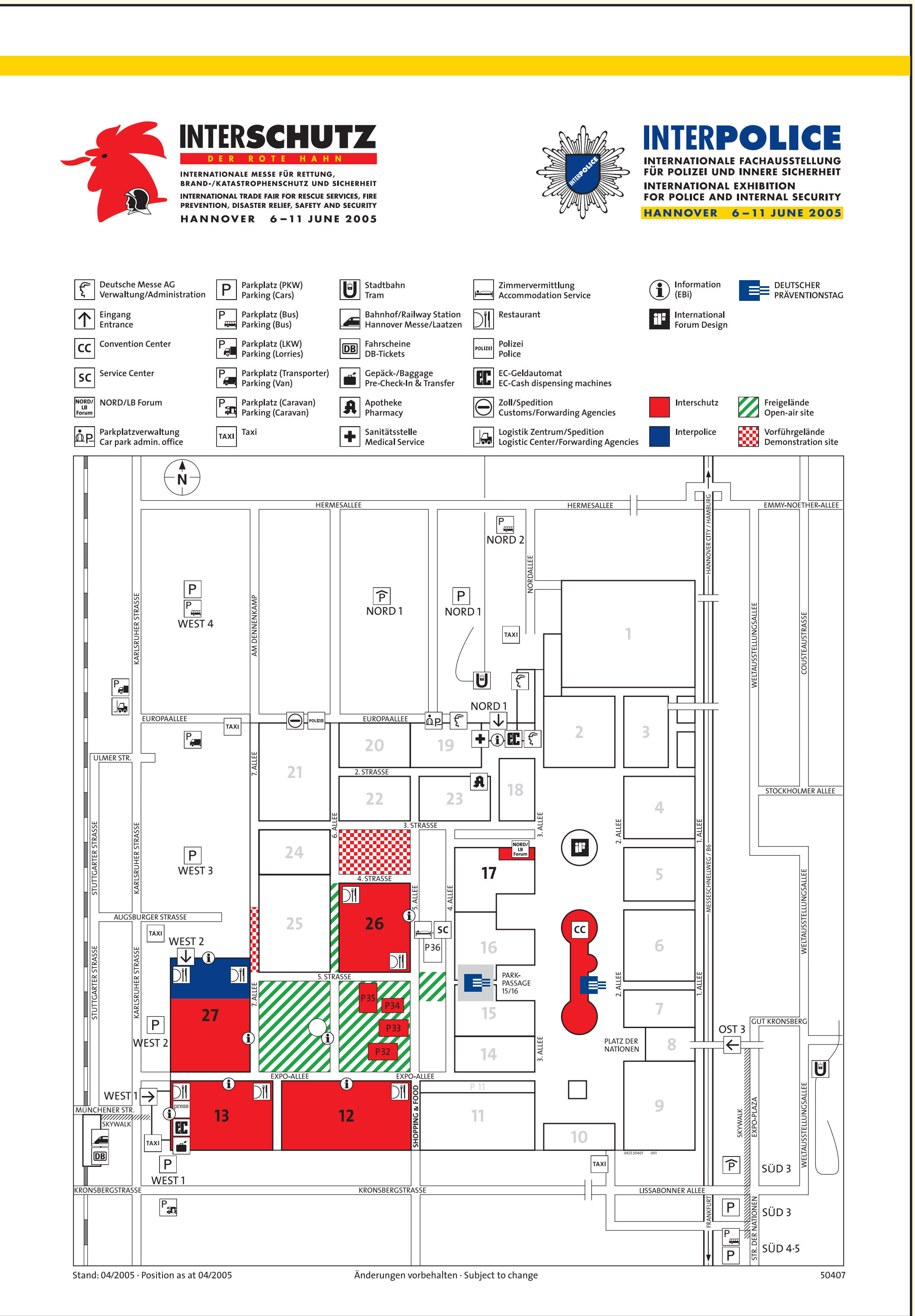
Ginge-Kerr Danmark
www.argonite.com
Hall 13, Stand C28

Great Lakes Chemical
www.greatlakeschem.com
Hall 13, Stand G40/1

HD FIRE PROTECT
www.hdfire.com
Hall 13, Stand B47

International Water Mist IWMA
www.iwma.net
Hall 13, Stand G51

Jonesco (Preston)
www.jonesco-plastics.com
Hall 13, Stand D19



Kerr Fire Fighting Chemicals
www.kiddefiresystems.com
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Kidde de Mexico
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Kidde Fire Protection
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Noveon Europe
www.blazemaster.com
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Patterson Pump Company
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Pilkington Deutschland
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RAE Systems Europe
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Reliable Fire Sprinkler
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Tornatech
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TOTAL WALTHER
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Tyco Bulding Services Products
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Tyco Safety Products
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Vimpex
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INTERSCHUTZ 2005 Preview

Company Profiles

AVK International A/S

AVK is one of the leading valve manufacturers for the water, gas and sewage industries as well as fire fighting worldwide.

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Market proximity has always been at the core of AVK's strategy; close contact with the end-user ensures close monitoring of the market and constant adaption and development of the product programme to meet with market requirements. This takes place in our development department in Denmark, an advanced technology centre, where ideas and suggestions from many different countries are gathered and where existing products are continually adapted and tested.

Production

Production takes place in Denmark, the UK, the Netherlands, France, Poland, the USA, Australia, Germany, China and Saudi Arabia. AVK's products are also produced under licence in several other countries.

AVK Focuses on the Environment

The products of AVK form part of infrastructures, which play an important role for the local environment the world over. AVK focuses on the environment as a natural consequence of this.

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HD FIRE PROTECT PVT. LTD.

HD FIRE PROTECT PVT. LTD. has specialised in manufacturing water and foam based fire protection products for over 15 years and exporting worldwide.

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The products manufactured are Deluge Valves, Alarm Valves, Spray Nozzles, Monitors, Proportioners, Bladder Tank, Eductors, Mobile Foam Units and Foam Sprinklers.

Quite few products manufactured are UL or FM approved.

Hall/Booth Number: 013, B47

Products at Interschutz: Water Monitors, Deluge Valves, Alarm Valves, Pressure Reducing Valves, Proportioners, Master Stream Nozzles, Water Spray Nozzles & Remote Control Monitors.

Contact: HARISH DHARAMSHI
Address: C-3/6, Nandanvan Industrial Estate, LBS Marg, Thane – 400 604, INDIA
Tel No: 091- 22- 25826958, 25826793
Fax No: 091- 22- 25812524, 55969049
Website: www.hdfire.com

Marioff

Marioff – the leader in water mist fire protection

Marioff is the leading supplier and developer of water-mist fire protection systems for both marine and land applications. Marioff's HI-FOG high-pressure water mist technology is based on rigorous full-scale fire testing, hundreds of patents and type approvals by approval bodies. It ensures fast suppression or extinguishment of the fire, radiant heat blocking to prevent fire spreading, minimised water damage to equipment, and safety for people and the environment.

The mist is delivered at a high velocity, achieved with pressures up to 140 bar, using small-bore stainless steel tubing and high-pressure pumps or charged nitrogen cylinders.

Some examples of application-specific HI-FOG systems:

- computer and telecom rooms
- hotels and offices
- museums and heritage buildings
- passenger ships
- cargo vessels,
- turbine enclosures
- cable tunnels
- offshore applications
- machinery spaces
- aircraft hangars

HI-FOG systems are engineered to meet IMO and NFPA 750 standards. They have received the widest collection of type approvals for water-mist applications in the industry from FM Global, VdS Loss Prevention, Det Norske Veritas, Lloyds' Register, Bureau Veritas, Germanischer Lloyd, and others.

Marioff currently markets and sells HI-FOG systems in nine countries directly to end customers through subsidiary companies to ensure the quality of application engineering, installation and commissioning. Distributors and agents in other areas are provided with strong support and co-ordination from corporate headquarters.

Contact details

Marioff Corporation Oy
P.O.Box 86 / Virnatie 3
FI-01301 Vantaa
Finland
Tel: +358 9 870 851
Fax: +358 9 8708 5399
E-mail: info@marioff.fi
Internet: www.marioff.com

Details of Marioff companies, distributors and agents around the world, and other information from: www.marioff.com.

Product or development highlights

Marioff has received in April 2005 new type approvals from VdS Loss Prevention for the protection of:

- Light and Ordinary Hazard 1 risks with SPU Sprinkler Pump Unit and HI-FOG 2000 nozzles
- Parking garages classified as Ordinary Hazard 2
- Cable tunnels

Stand number

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Ginge-Kerr

Ginge-Kerr, founded as a fire extinguishing company in 1917, has based their experience in gas extinguishing systems on many years' development, design, and supply of CO_2 and Halon systems for the marine and industrial sector. After the ban of CFS's, we have based our strategy on the most environmental solution, Inerts. Besides the environmental issue a main point of view was that legislation forced industry to demolish well functioning Halon systems and replace with something more environmental friendly. This could happen again with HFC's.

Ginge-Kerr developed the Argonite system, based on Nitrogen and Argon, and we started to sell 150 Bar systems in 1992 and in 1995 we changed to 200 Bar which meant increased compatibility with regards to price and occupied space for the cylinder battery. Following we continued to develop the 300 Bar system. As EU worked with new directives for Pressure Equipment (PED) and Transport Pressure Equipment (TPED), and these directives included more severe test requirements, we decided to redesign our cylinder valve concept to comply with these new directives. In 2000 we launched our new 300 Bar system, which has been tested according to all new standards. The 300 bar system is approved by regulatory bodies throughout the world, including FM, LPCB, and VdS.

Ginge-Kerr is supplying the most sophisticated Inert Gas Extinguishing Systems, and our Argonite Systems are used to protect satellite control station, F16 test chamber, underground control facilities for the biggest submersible highway/railway tunnels worldwide, airports and more than 50,000 installations all over the world.

Ginge-Kerr develops for a more environmental friendly future.

Peter O. Jensen
Marketing Manager, Ginge-Kerr Danmark A/S

Tornatech Inc.

Manufacturer of fire pump controllers and other industrial pump controllers

Hall/Booth Number: Hall 013 Booth B03

Products at Interschutz: Fire Pump Controllers

Contact: Bruno Goupil
Address: 7075, Place Robert-Joncas, #132
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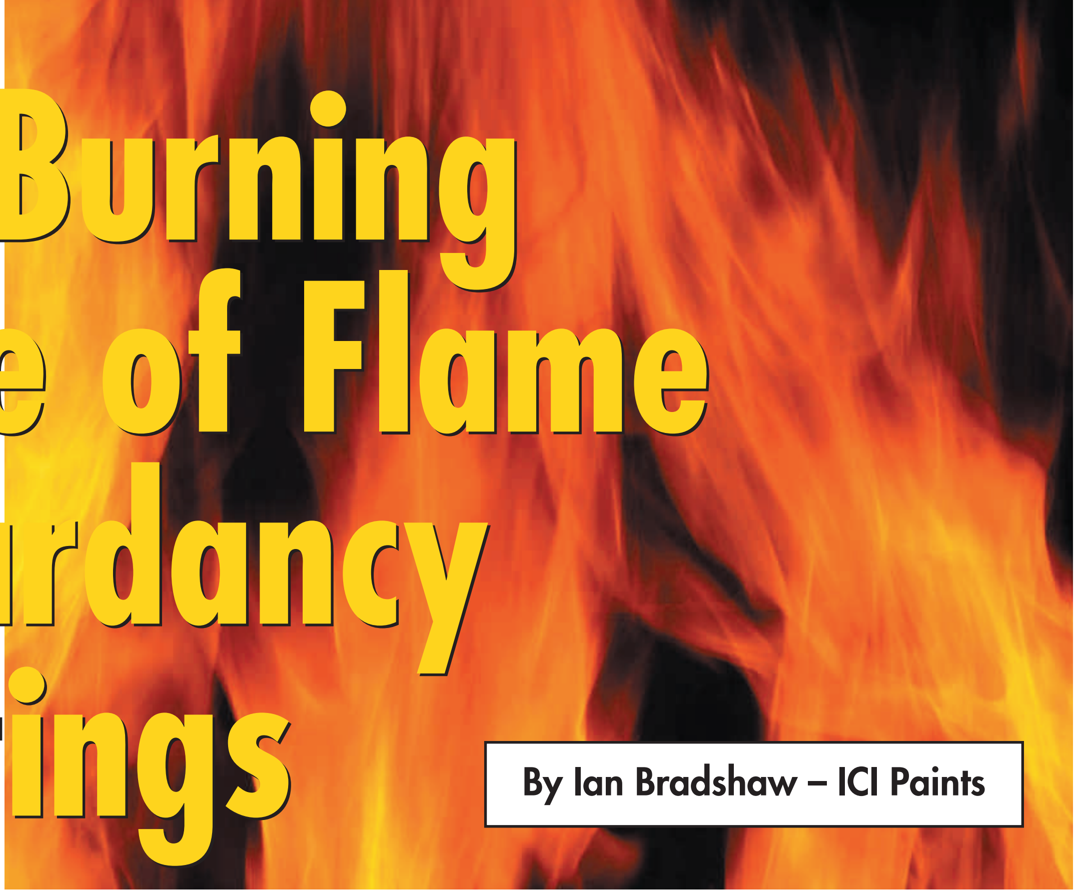
The Burning Issue of Flame Retardancy Coatings



By Ian Bradshaw – ICI Paints

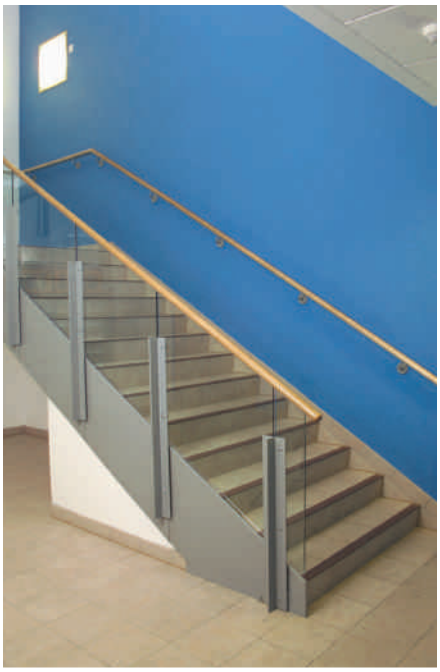
Delaying the spread of fire within a building is vital

ACCORDING TO THE ODPM, UK Fire Rescue Services attended over 1 million fires and false alarms, which resulted in 612 fire related deaths, during the 2003/4 period. These statistics clearly show that although much is being done to try and tackle the potential fire hazards within a building, there is still some way to go and that the importance of fire safety must remain a priority for all concerned. Ian Bradshaw, Group Brand Manager at ICI Paints explains how the correct specification of flame retardant coatings can go a long way in helping to reduce the spread of fire and, even more importantly, save lives.

LEGAL RESPONSIBILITIES

Fire should of course be the primary concern for specifiers, contractors, building owners and managers alike, particularly when the building concerned is multi-occupancy or residential such as an apartment building, hospital, hotel or care home. If a fire does break out then it is essential to make sure that the occupants can escape from the building safely and not be held back by the spread of fire or overcome by fumes.

For new buildings, meeting legal requirements is relatively straightforward to ensure as Approved Document B of the Building Regulations stipulates that the lining of the building must be able to resist the spread of fire over the surface. More specifically, when it comes to multi-occupancy buildings, internal linings must be a minimum of Class 1, and Class 0 for communal, high risk circulation areas and escape routes.



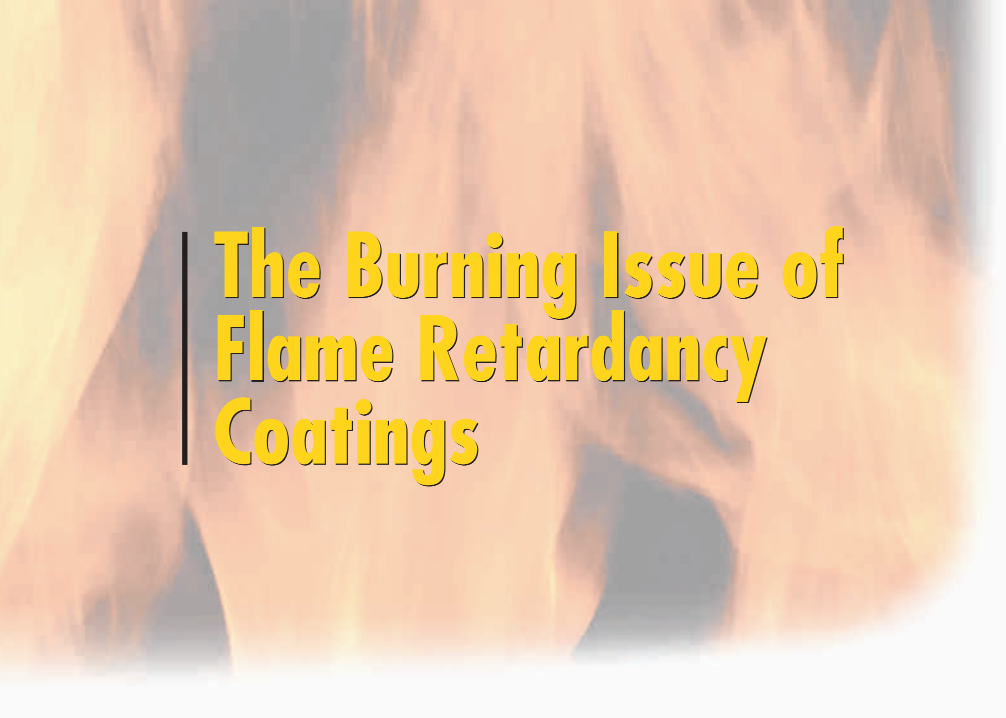
Maintenance of multi-occupancy residential properties must ensure that the walls and ceilings, especially in corridors and escape routes, meet the prescribed level of flame retardancy

THE PROBLEM

The real concern is for existing buildings, especially those where additional layers of paint have been added to the walls as part of planned maintenance programmes. In these cases it is quite likely that the walls will no longer meet fire legislation requirements and could in fact not only contribute to but also accelerate the spread of flames by the build up of paint coatings altering the fire performance of the walls and acting as a fuel source.

Although the Building Regulations do not explicitly cover existing buildings, those responsible for a building do have a Duty of Care to ensure that the highest achievable standards of fire safety are achieved. This means that they have an obligation to take into account any potential fire risks as a result of redecoration, particularly in public and communal areas such as corridors.

According to Warrington Fire Research, dried paint (irrespective of whether it's solvent or water-based) contains combustible materials which can contribute to the spread of a fire. To apply layers of paint on top of each other simply worsens the areas already at risk. In order to overcome this



The Burning Issue of Flame Retardancy Coatings

problem, those responsible for the maintenance of multi-occupancy residential properties must ensure that the walls and ceilings, especially in corridors and escape routes, meet the prescribed level of flame retardancy.

PROOF OF THE PROBLEM

A fire at Moston Hospital in Cheshire clearly demonstrated the devastating effect the build up of multiple layers of paint can have on a building. Only three minutes after the alarm had been raised at the Hospital, the flames had spread an alarming 50 metres along the walls and ceilings. An investigation involving Warrington Fire Research Centre following the incident found that a sample of painted plasterboard lining from a similar corridor had over 18 separate layers of paint on it. When tested, this sample demonstrated a worrying rapid spread of flame.

Moston Hospital is unfortunately not a one off occurrence. Over the years similar fires have occurred in the stair-wells of high rise blocks of flats in London and in low rise properties in Birmingham. These instances coupled with the tragic death last year of 14 pensioners following a care home fire in Lanarkshire can only increase con-cerns about how quickly flames spread along a surface.

THE SOLUTION

So how can you ensure that a surface does not add fuel to the fire? Removing all existing paint coatings can be costly and time consuming. Flame retardant coatings on the other hand provide the perfect solution to this problem by offering a cost effective alternative while also allowing the wall or ceiling surface to be returned to its original standard.

These flame retardant coatings come in three main types: thin film, intumes-cent and barrier coatings. Each type of coating is effective to varying degrees in slowing the spread of flame, but not all are as suitable or effective and with no definitive standard for testing sys-tems such as these, it can be difficult to decide which one really offers the best in flame retardancy.

The increasingly recognised industry standard test for determining whether a coating does offer a high standard of flame retardancy is the Warrington Blue Board. This replicates a worst-case sce-nario (Class 4) for wall and ceiling sur-faces and is the industry benchmark for the upgrade performance of a coating. Each system should be tested on the Blue Board in accordance with BS476 Part 6 to determine heat release from the surface and Part 7 for the spread of flame across the surface. For a system to offer acceptable levels of flame retardancy it should be able to upgrade the Warrington Blue Board to Class 1 or, ideally, Class 0 which is the opti-mum level for walls and ceilings.

Unfortunately, simply being able to upgrade a lining to Class 1 or Class 0

The increasingly recognised industry standard test for determining whether a coating does offer a high standard of flame retardancy is the Warrington Blue Board.

A wide range of finishes and colours can be used with systems such as Pyroshield so the aesthetics of a building need not be compromised for fire safety

THANKS TO PERFORMA

YOU STILL HAVE A BUSINESS!

Are you aware that under new fire legislation all employers will have to do a fire risk assessment to ensure business continuity and contain the spread of fire and smoke.

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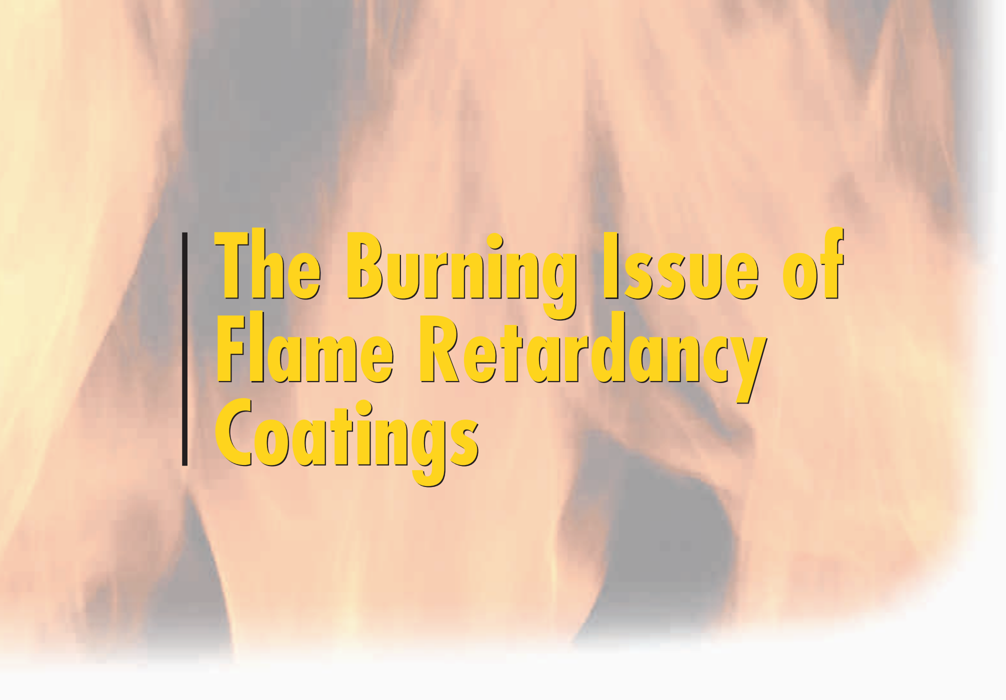

The Burning Issue of Flame Retardancy Coatings

does not mean the most favourable solution has been found. The formulation of these products must also be taken into account to ensure that the system selected really is offering the best solution in terms of health and safety.

Thin Film

Flame retardant coatings work by removing one of the basic elements of fire: heat, fuel or oxygen. Remove one of these elements and the fire will extinguish. Thin film based flame retardant coatings work by eliminating the fuel in the fire by way of the chlorine/bromine. This neutralises free radicals which can mix with flammable gases while the antimony accelerates the reaction, reducing the fuel in the fire.

Although thin film based coatings effectively prevent the spread of flame, there are increasing health and safety concerns relating to antimony oxides and brominated compounds which should be considered.

Intumescent

Intumescent flame retardants have traditionally been seen as an effective means of restricting flame spread within a building. Usually used on wood and structural steel, intumescents expand when they come into contact with the heat from a fire. This intumescent layer then protects the substrate, starving the fire of oxygen and fuel so that it eventually burns out. Again there is a downside to intumescent flame retardants in that they have long drying times and washing or overcoating the surface can be problematic as the active ingredients are water soluble.

Barrier

The third type of flame retardant coatings are barrier coats. These work by providing a thick barrier which insulates the substrate from the heat. Previously seen as complex, 2 pack systems which can be difficult to apply, recent years have seen some quite significant developments which mean that barrier coats are now generally seen to provide the most effective solution to flame retardancy requirements.

For example, the new generation of products such as Pyroshield, a single pack system from Dulux Trade, are designed for ease of application while also providing superior levels of flame retardancy. This system is free from antimony and brominated compounds and uses low hazard mineral flame retardant chemicals which react in a fire to take in oxygen and create steam to suppress the flame. The coating also forms a thermally stable char which in turn separates the fire from the paint coating to remove the fuel source.

The issue of fire, particularly limiting the spread of fire, is an extremely important one for multi-occupancy or residential such as an apartment building

IN CONCLUSION

In terms of addressing the fire safety of high risk areas such as corridors, escape routes and communal areas within multi-occupancy and residential buildings, then only Class 0 should really be acceptable. When it comes to limiting the spread of fire, flame retardant coatings can make a considerable difference and provide valuable time for people to evacuate a building safely. However, when comparing the various types of flame retardant coatings that are on the market today, barrier coatings, particularly the new generation such as Pyroshield, provide the greatest advantages, not only in terms of limiting the spread of fire, but also in general health and safety terms.

So, making the right choice by specifying the correct flame retardant coating not only means compliance with fire legislation, but can also be the difference between life and death.

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Fire Protection Considerations for Telecommunication Central Offices

By Mark L. Robin, Ph.D. and Lawrence A. McKenna, Hughes Associates, Inc.

Cable Vault showing splice closure (inside looped cable being installed)

THE TELECOMMUNICATIONS INDUSTRY IS one of the fastest growing industries on the planet. Global telecommunications revenues totaled approximately $1.3 trillion in 2003, with projections of high single-digit percentage growth over the next several years. Telecommunications companies worldwide have spent billions of dollars to ensure that voice, data and video routes operate reliably, and of primary concern to these providers is the minimization of service disruptions. One of several possible causes of service disruption in telecommunication facilities is fire. In this article we discuss the selection of detection and suppression systems for the protection of telecommunication facilities. Additional considerations may be found in NFPA 76, *Standard for the Fire Protection of Telecommunication Facilities*, 2005 edition, which provides detailed requirements for fire protection of telecommunication facilities.

THE TELECOMMUNICATIONS INDUSTRY

Over the last few years, telecommunications has progressed from an industry involving a single service, standard telephone service, to one which affects numerous facets of our daily life, and includes not only standard telephone service, but also automatic teller machines (ATMs), facsimile machines, teleconferencing services, video conferencing services, point of sale transaction terminals, electronic funds transfer, cable TV and Internet access.

It has been estimated that in 2001 approximately 2,000 service companies provided telecommunications in the United States alone. These telecommunication companies operate networks ranging in size from rural companies servicing several thousand customers, to large companies serving millions of customers. Central offices (also termed "switching centers") house the primary control equipment for these networks, and it is estimated that there are approximately 24,000 central offices within the U.S. telecommunications network.

The U.S. market is currently the largest global telecommunications market in terms of revenues: U.S. telecommunication revenues in 2004

The U.S. market is currently the largest global telecommunications market in terms of revenues: U.S. telecommunication revenues in 2004 are estimated to be over $400 billon, and represent 30 percent of global telecommunication revenues.

Fire Protection Considerations for Telecommunication Central Offices

Typical Telco Battery Plants

are estimated to be over $400 billon, and represent 30 percent of global telecommunication revenues. It is expected that over the next five years the U.S. market share will remain near this level, with annual revenues increasing to approximately $500 billion in 2009. Western Europe, Asia Pacific, and Latin America are the major telecommunication markets outside the U.S., and are projected to undergo growth approaching double digit percentages over the next few years. Total global telecommunication revenues of $1.7 billon have been projected by 2009.

CENTRAL OFFICES

Central offices house the primary control equipment for telecommunication networks. While the size of central offices varies widely, equipment layouts and functions are similar. Many central offices are highly automated and are either unstaffed or have limited staff present only during standard working hours. Cables typically enter and leave the central office through a *cable vault* where they are spliced to smaller cables for distribution throughout the facility. US codes require that cables inside a building comply with stringent criteria for flame spread; the cables used outside a building are exempt from such regulations. The cables then rise through the building to a *main distributing frame* (MDF) where they separate into individual pairs of wire for each circuit and connect to cables leading to the *switching systems*. After switching, signals pass to *transmission systems* which multiplex and boost the signals. Finally, the signal travels back out the facility through the cable vault over other cables. In addition, the central office contains standby generators, battery systems and associated power and distribution equipment. In remote areas, all of these components may be housed in a single room, whereas large facilities may involve one or more rooms or floors of a building.

Service interruption is a major concern in telecommunication facilities due to the unique nature of the information processing performed in such facilities. Telecommunication systems are on-line information exchange systems, that is, the system does not store or process customer data but merely transfers the data from one point to another. When a disruption occurs, all information in transit is lost. This contrasts to the case of data processing centers, where data is stored in the systems memory, and during an interruption only that data which has not yet

Table 1: Estimated Downtime Impact per Minute for Various Business Applications

Business Application	Estimated Outage Cost per Minute
Supply Chain Management	$11,000
Electronic Commerce	$10,000
Customer Service Center	$3,700
ATM	$3,500
Financial Management	$1,500
Messaging	$1,000
Infrastructure	$700

Source: Alinenan ROI Report, January 2004

been placed in permanent memory (disks, tapes) is lost.

The financial impact of a service disruption can be significant. The estimated downtime impact per minute for various business applications is shown in Table 1. The downtime impact for a typical computing infrastructure is estimated at $42,000 per hour. Downtime impacts for companies relying entirely on telecommunications technology, such as online brokerages or e-commerce sites can reach $1 million per hour or more.

DETECTION DEVICE SELECTION

A number of studies have noted that fires in telecommunication facilities involve small quantities of materials burned and small areas of fire damage, and the types of fires characteristic of telecommunication facilities have been discussed in detail in the literature. Fire hazards in such facilities are characterized by low fuel loads, and include wire insulation, printed circuit boards, electronic components, transformers, insulating materials and plastic housings. Fires in such facilities are typically of low energy output, often less than 5 to 10 kW in size.

Fire damage to electronic equipment can result from three sources. Thermal damage due to the fire itself, nonthermal damage due to combustion products, and nonthermal damage due to the decomposition products of the fire suppression agent. Thermal damage, due to flaming combustion and heat, is possible at relatively low temperatures. For example, paper records can be damaged at temperatures as low as 350°F and disk drives can be damaged at temperatures as low as 150°F.

It is well known that massive damage is possible due to short-term exposure of electronic equipment to fire combustion products. Pyrolysis of almost any organic material will produce corrosive combustion gases and carbon soots. For example, HCl is a common product formed from the combustion of PVC cable, and will attack galvanized zinc, commonly encountered in electronic circuitry and components, resulting in the formation of zinc chloride on the equipment surface. Zinc chloride is hygroscopic, and picks up moisture from air at as low as 10% relative humidity, forming a corrosive liquid zinc chloride solution. Several studies have found that the corrosive properties of smoke, soot and particulate matter are of more concern than halogen acids. According to the Federal Communications Commission' (FCC) Network Reliability Council Report, as much as 95 percent of all damage caused to computer and digital switching equipment by fires can be characterized as non-thermal damage, i.e., smoke damage.

Modern Multiplex Transmission Equipment

By employing rapid detection and rapid extinguishment, fires can be extinguished while still in their incipient stages, and the formation of combustion products limited to levels below the damage thresholds. Detection systems employed in telecommunication facilities are designed to detect fires in their incipient stages, and there is an industry wide desire to detect fires at as small a size as possible. Telecommunication industry leaders have indicated their desire for detection of typical equipment fires in telecommunications facilities at a fire size of 1 kW, whereas for highly sensitive equipment detection at a fire size of 0.1 kW is desirable.

Detector selection for the telecommunications industry can be based upon the level of damage deemed tolerable, as seen in Table 2. Note that a fire size of greater than 100 kW is associated with a major loss in the telecommunications industry.

FIRE EXTINGUISHING SYSTEM SELECTION

Fire extinguishing systems permitted for the protection of telecommunication facilities under NFPA 76 include

Telecommunication industry leaders have indicated their desire for detection of typical equipment fires in telecommunications facilities at a fire size of 1 kW, whereas for highly sensitive equipment detection at a fire size of 0.1 kW is desirable.

Fire Protection Considerations for Telecommunication Central Offices

sprinkler, clean agent, and water mist systems. Because water can cause damage to electronic equipment, the use of water-based systems is of concern to many system designers. According to the FCC Network Reliability Council Report, the corrosive damage due to water when employed as an extinguishing agent in telecommunication areas containing powered electronic equipment can be as extensive as that caused by a fire or by corrosive smoke.

The inert gas based clean agents do not decompose during fire suppression, and hence do not form any corrosive decomposition products which could damage electronic equipment. It is a well established fact that the halocarbon based clean agents produce HF during fire suppression, which can be corrosive to electronic equipment at high concentrations. The amount of HF formed is dependent upon the size of the fire, and several studies have demonstrated that through the use of a sensitive detection system (to provide detection in the incipient stage) and a rapid agent discharge (to achieve rapid extinguishment) the amount of HF formed can be limited to levels below those which result in damage to electronic equipment.

It is important to note that the primary purpose of a sprinkler system differs significantly from that of a clean agent system. The primary purpose of a sprinkler system is to *protect the structure,* and to confine the fire to its room of origin, whereas the primary purpose of a gaseous clean agent system is to *protect the valuable and/or sensitive assets* within the enclosure.

Clean agent systems employ rapid detection and rapid agent discharge, resulting in the extinguishment of the fire while still in its incipient stage. Sprinkler system activation occurs when the sprinkler head's fusible link or glass bulb reaches the head's rated temperature (approximately 135°F or higher). The attainment of such temperatures at the sprinkler head requires a relatively large fire, and as a result the damage to assets at the time of actuation of a sprinkler system will greatly exceed the damage at system actuation experienced with a clean agent extinguishing system.

For applications involving expensive, sensitive and critical equipment, substantial risk reduction at very high benefit/cost ratios may be realized by protecting these facilities with *both* a gaseous clean agent (to protect the assets), *and* an automatic sprinkler system (to protect the structure). Such a combination represents a logical and viable solution to the fire protection needs of such facilities.

Table 2. Detection Device Selection Based On Potential Loss Characterization

Potential Loss Characterization	Fire Size	Suitable Detection Device
Major	100 kW or greater	Standard or fast response sprinkler
	50 – 100 kW	Spot type heat detection device
Large	5 – 50 kW	Spot or linear beam detector at "listed" spacing or Line type heat detector at reduced spacing
Moderate	2 – 5 kW	Incipient (air sampling) detection system at 'listed' coverage. Spot or linear smoke detectors installed with reduced spacing
Small	less than 2 kW	Incipient (air sampling) detection system installed with reduced coverage area. Smoke detectors installed within equipment cabinets

CONCLUSION

In this article we have provided a brief look at some of the considerations to be made in the selection of detection and suppression systems for the protection of telecommunications facilities. The reader is directed to NFPA 76, *Standard for the Fire Protection of Telecommunication Facilities*, 2005 edition, for the discussion of additional considerations.

Mark L. Robin, Ph.D., is a Senior Scientist with Hughes Associates, Inc. and has over 15 years of experience in the fire suppression industry, including the development, testing and approval of fixed and portable fire suppression agents and systems.

Lawrence McKenna is a recognized expert in fire protection of telecommunications and similar facilities. Prior to joining Hughes Associates in 1996, Mr. McKenna was a Distinguished Member of Technical Staff in AT&T's Environmental and Safety Engineering Division. While there, he was responsible for the development and implementation of corporate loss prevention programs. He has lectured and written extensively on the topic.

INTERNATIONAL FIRE PROTECTION

AUGUST ISSUE 2005

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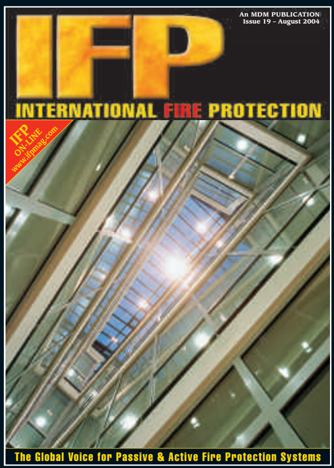

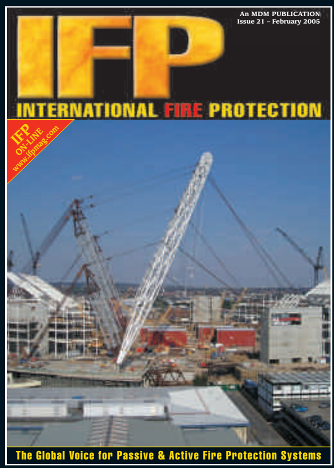

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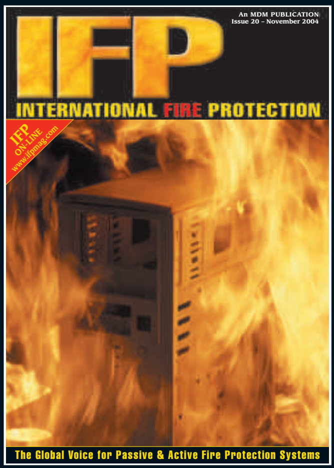

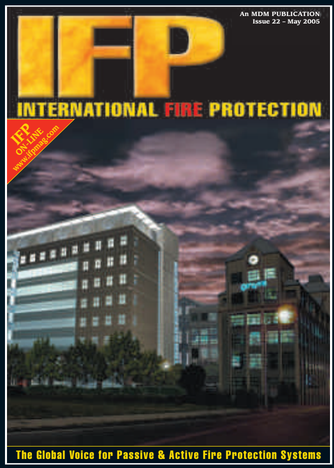

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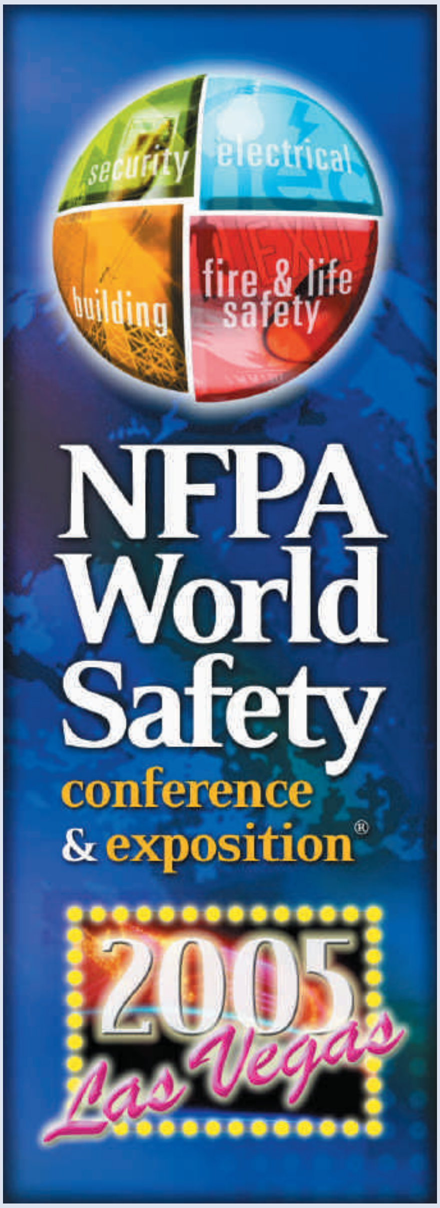
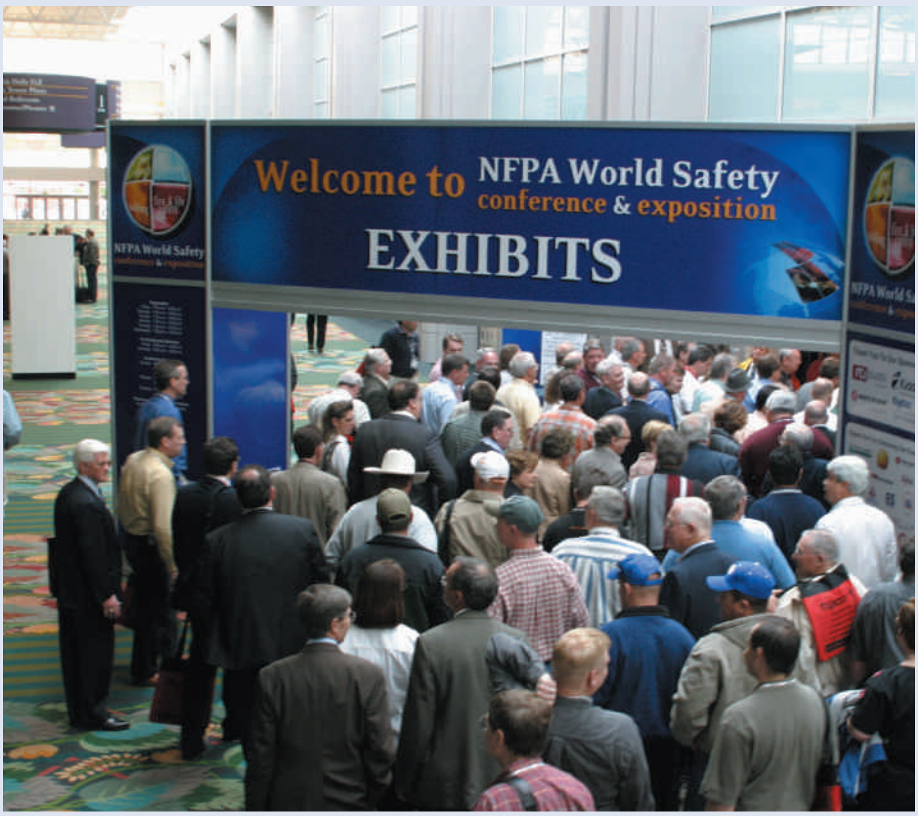


New dates, new destination and a consolidation of conferences signify a new beginning for the 2005 NFPA World Safety Conference & Exposition (WSC&E). The 2005 WSC&E being held June 6-10 at the Mandalay Bay Convention Center in Las Vegas, Nevada will be the largest event in NFPA history. This is due in part to the great Las Vegas location and to the fact that the NFPA Fall Education Conference was recently merged into the WSC&E.

Over 140 education sessions will be offered, including powerful case studies, lectures, and panel discussions. A number of sessions will deal specifically with performance-based design as it is applied to some of Las Vegas' unique environments. Experts from some of the most recognizable organizations in the fire protection industry including; FM Global/Factory Mutual Research, Rolph Jensen & Associates, Underwriters Laboratories, and the National Institute of Standards and Technology (NIST) will discuss recent developments involving fire protection codes and standards.



Among the many great sessions being offered this year is Wednesday's featured presentation. Dr. William Grosshandler and Dr. Shyam Sunder of NIST will be discussing NIST's findings on the World Trade Center Fire and Collapse. Hear what led to the structural failure and subsequent collapse of WTC 1,2, and 7 and hear NIST's recommendations on how to better protect people and property, as well as enhance the safety of first responders in the future.

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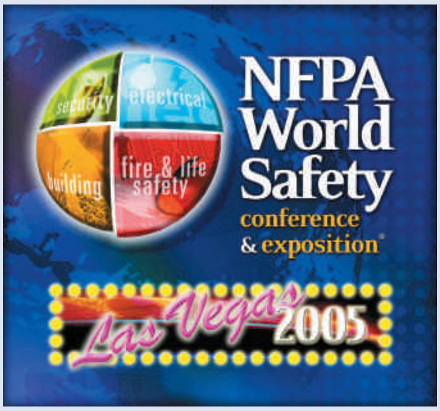

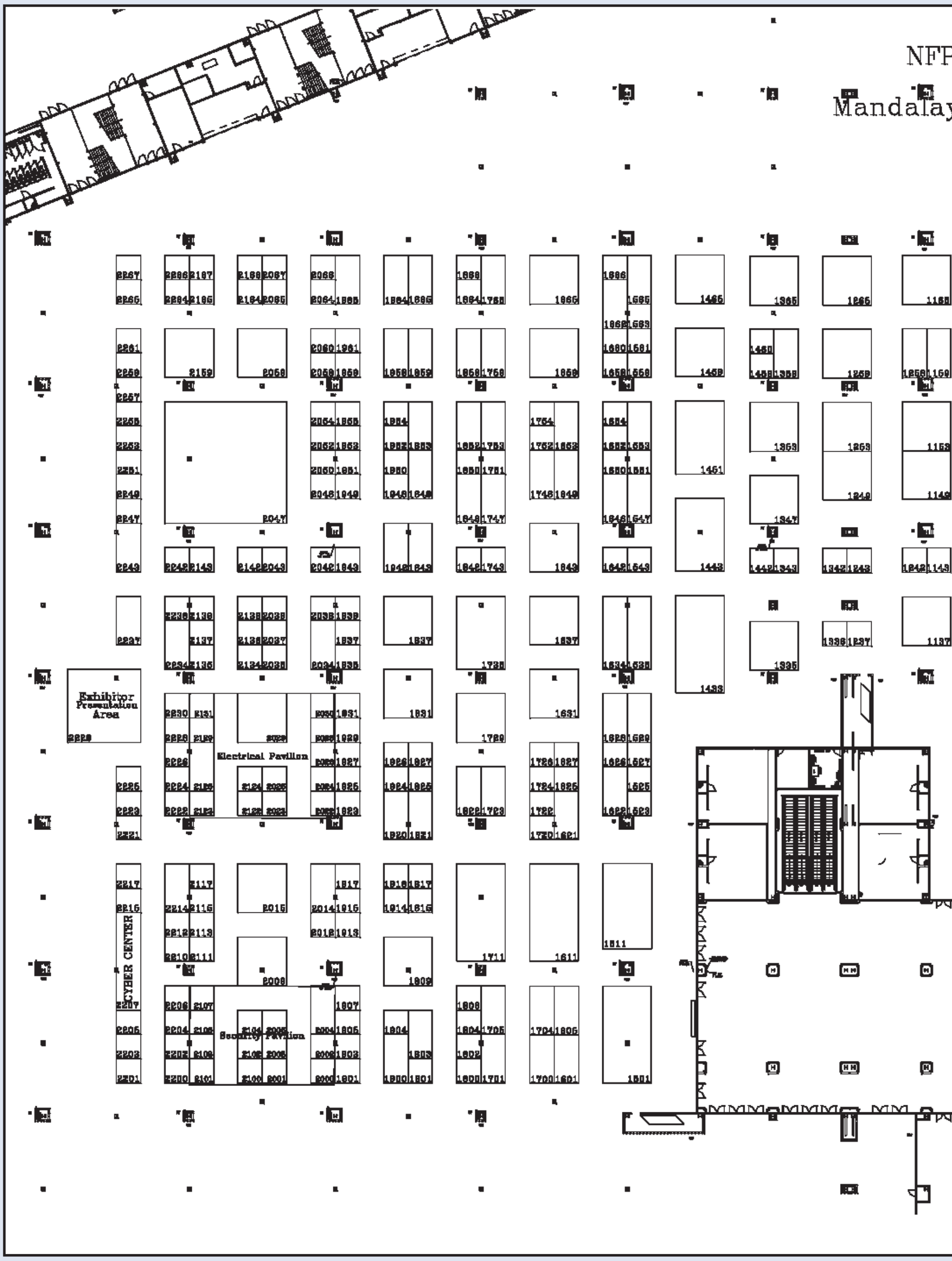

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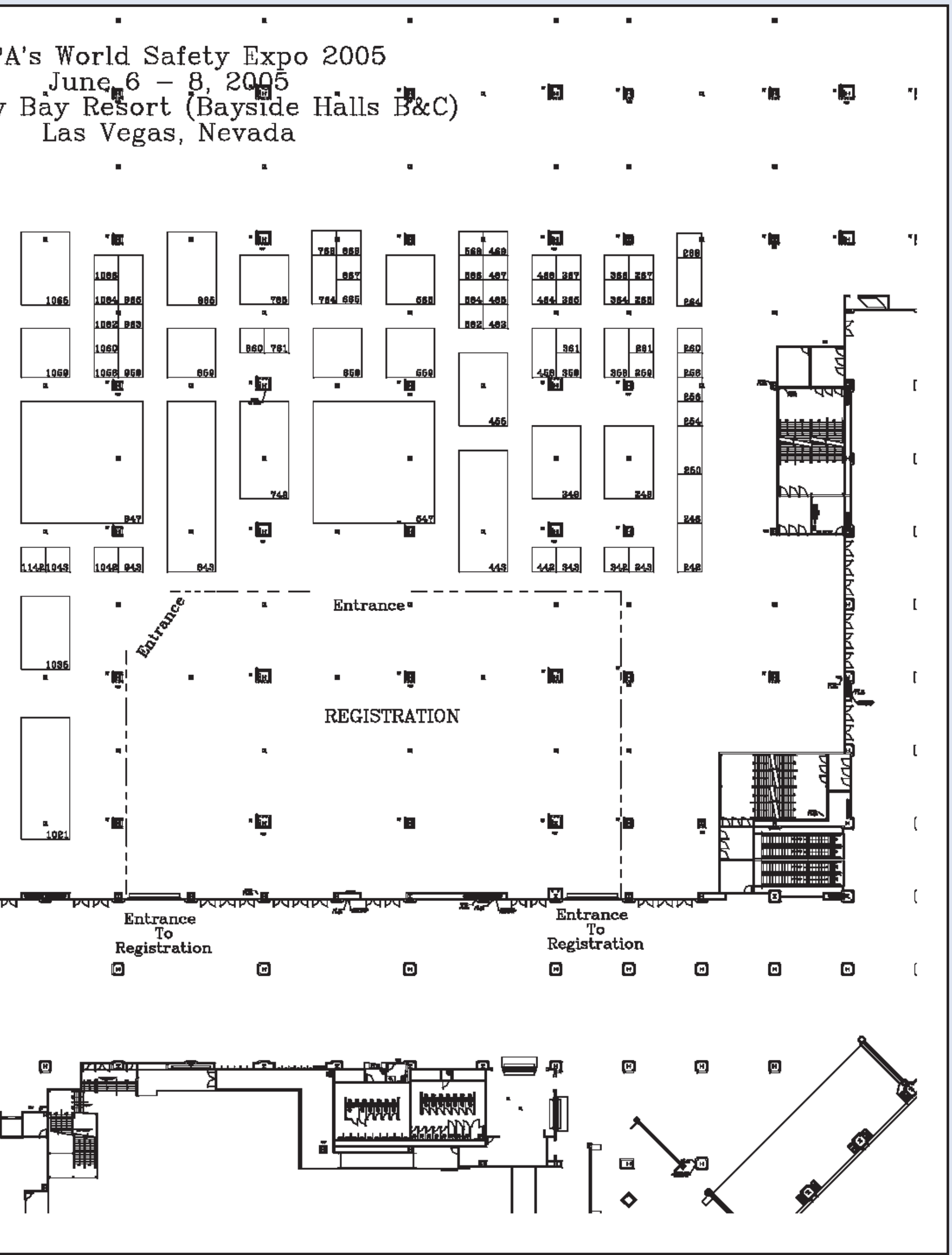

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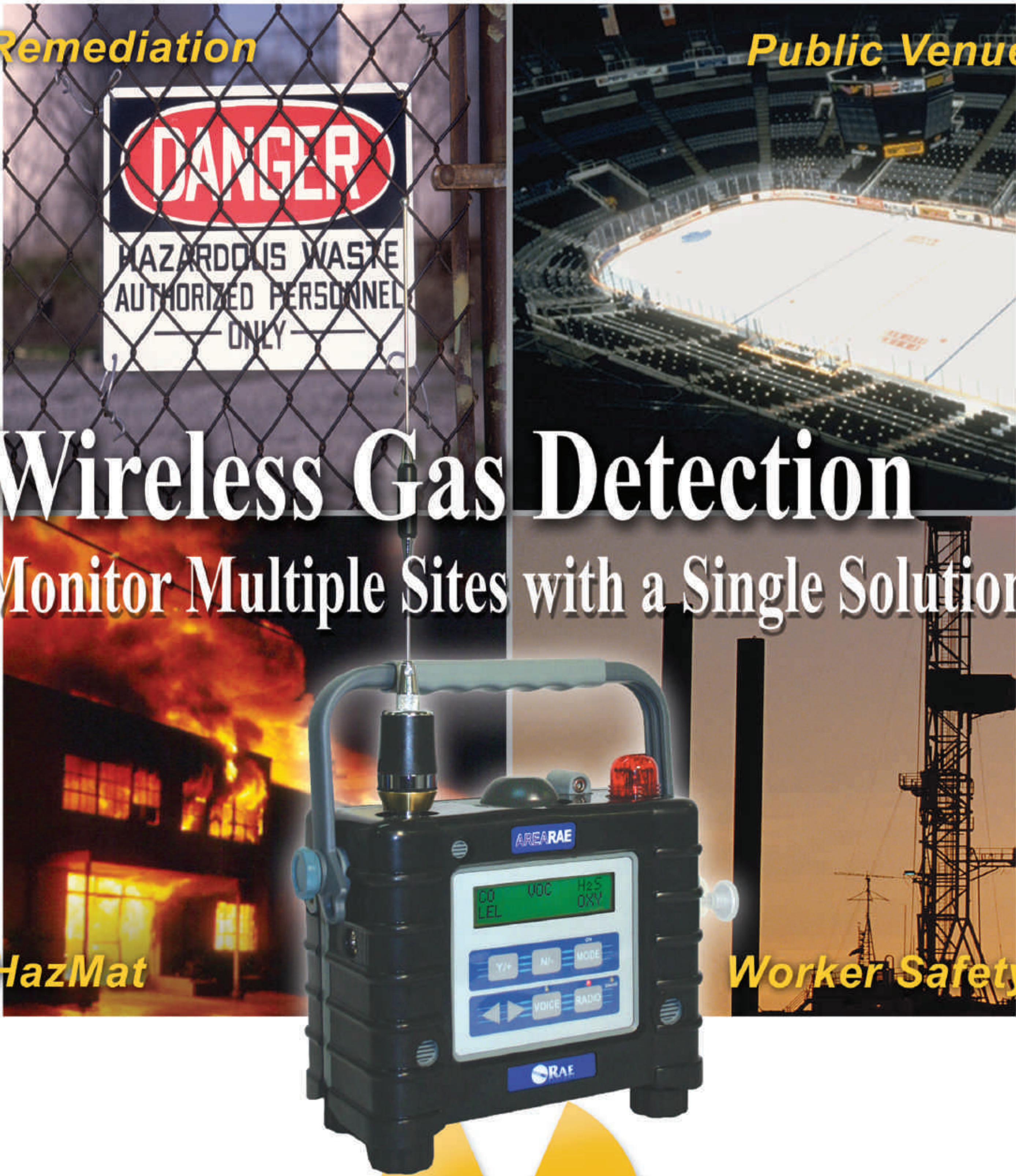

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Gas Detection in Industrial Plants

By Marco Oggioni of Oggioni s.a.s., Italy

IN MANY INDUSTRIAL PLANTS the possible leaks of toxic or flammable gas constitutes the primary source of hazard for plant/building or for the health of the workers.

For this reason the fast detection of gas leaks or vapour clouds is important to prevent hazardous conditions, in these cases fixed gas detection systems assume a primary role in the safety.

A good system is the result of a good project that will have to find the best compromise between the benefit of a system in terms of efficiency and cost.

The guideline is the optimisation of the relationship between the economic factor that obviously is not possible to underestimate and the number and the type of detectors necessary to assure a fast time of response and the best probability of detection.

There are a lot of factors which should be taken into account in determining the suitable location of sensors and depend on the site location.

Indoor or outdoor site monitoring, present different problems, due to the mechanical ventilation, the structure of the building or the variations in wind direction and speed.

For an objective and precise sensor location, the measurement of the air movements through the building, or the identification of the potential components vulnerable to leakage such as break in the pipe work, valves, flanges, pressure regulators, sight glasses, pump and compressor, play a fundamental role.

Another factor to take into consideration when deciding where to position the sensors is the type of gas that has to be detected.

Usually, for gases with a density of less than the air (hydrogen, methane, etc.), the sensors are uniformly distributed at about 30cms, from the highest point of the ceiling, because these gases are easily defused in the air.

It is also to avoid places where there are air currents or where the air is likely to be very still because of certain irregularities of the ceiling e.g. beams etc. which stop the gas moving around freely.

For gases with a higher density than the air, the sensors should be placed near the floor and in proximity to possible points of leak.

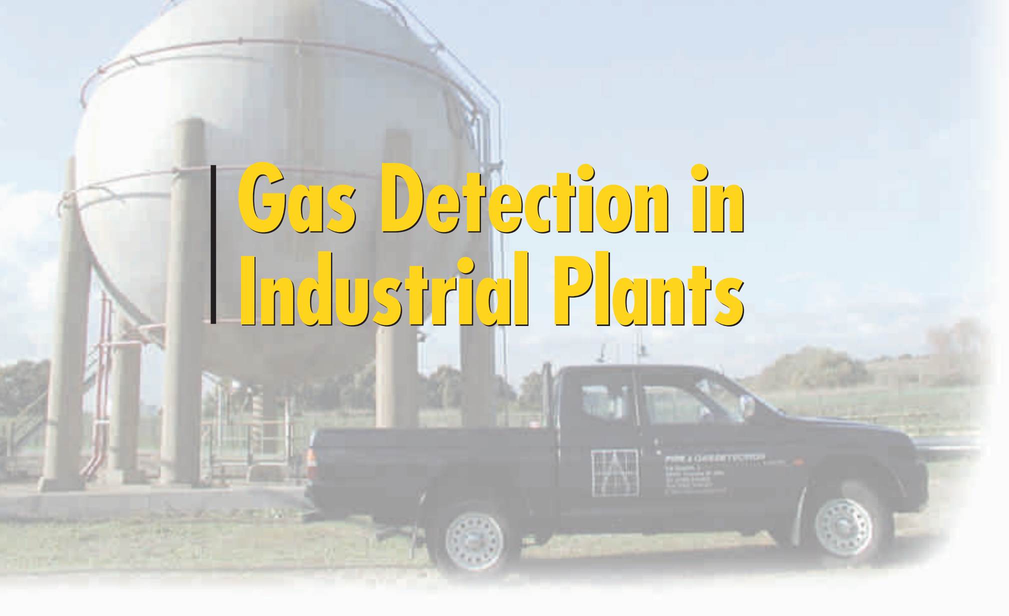
Particular points such airspaces, junction boxes, manholes, and a sensor should always control weighbridges.

For gases with a specific weight similar to that of the air or for toxic substances in low concentration it is a good general rule to distribute the sensors at different levels so as to heighten the chances of intercepting an eventual leak.

Up to now for the detection of flammable gases the catalytic gas detector or 'pellistor', as it is colloquially known,

For gases with a specific weight similar to that of the air or for toxic substances in low concentration it is a good general rule to distribute the sensors at different levels so as to heighten the chances of intercepting an eventual leak.

Gas Detection in Industrial Plants



is the main technology used.

This technology based on the catalytic oxidation, has a good relationship price/performances but requires a periodically maintenance by exposure of the sensors to standard test gas mixtures at regular intervals to confirm the correct efficiency.

There are certain substances that if present in the atmosphere to be analysed can alter considerably the response of the sensor. These in the main are chemical poisons.

The more important poisons are:

Halides	(Compounds containing fluorine, chlorine, bromine and iodine)
Glycol Sulphur	(Compounds which polymerise on the bead)
Heavy Metals	(Tetraethyl lead)

Modern catalytic sensors show a far greater resistance to this effect but in all cases if the presence of these substances is to be expected on the site in which the sensors have been installed, it is advisable to verify frequently the sensitivity of the detectors using calibration gas.

The infrared flammable gas detectors are an alternative to the use of pellistors in the detection of flammable gases.

These sensors measure the amount of radiation that is absorbed by vibration of the C-H bond in the 3.4 m^2 region; the position of maximum absorption depends on the particular hydrocarbons.

The initial investment for this technology is greater but sensors based on infrared absorption offer a potentially

longer life, a faster response time and smaller costs of maintenance and can be made to “fail safe”.

For the detection of gas or vapour clouds the IR Open Path Detector have an important role to play.

In this technique the IR Source is separated but aligned with the IR Detector, and a beam of infrared radiation crosses all the hazardous area to be protected.

This may be an alternative proposal to the usage of large number of point detectors.

For Toxic gases the electrochemical cell is the more used technology.

An electrochemical cell is a type of gas-battery developed from fuel cell research.

These sensors are usable in temperate climates, but their main weakness is their failure at high temperature and with an upper temperature limit of about 40°C.

The Semiconductor Gas Sensors, Metal Oxide Semiconductor (MOS) based, is a technology in continuous evolution and in many cases it could be a valid alternative to the electrochemical cell and constitutes an option for hot climates, or for extreme environmental conditions, where electrochemical cells are inappropriate.

A lot of gases may be detected with this technology, e.g. Ammonia, Hydrocarbons, Carbon monoxide, Alcohol, Hydrogen Sulphide, Arsine and Oxygen.

In general, however, MOS detectors are sensitive to a number of gases, this means that is important to know all the possible gases that can be present in the environment and take into consideration their effect.

Communication of the gas concentration is typically achieved via a 4-20 mA current loop between a control card and the sensors.

The control card must show if the apparatus is energized, a fault signal in the event of sensor’s failure, loss of continuity in one or more of the wires to the sensor or open or short circuit in the connection to the sensor.

In general, MOS detectors are sensitive to a number of gases, this means that is important to know all the possible gases that can be present in the environment and take into consideration their effect.

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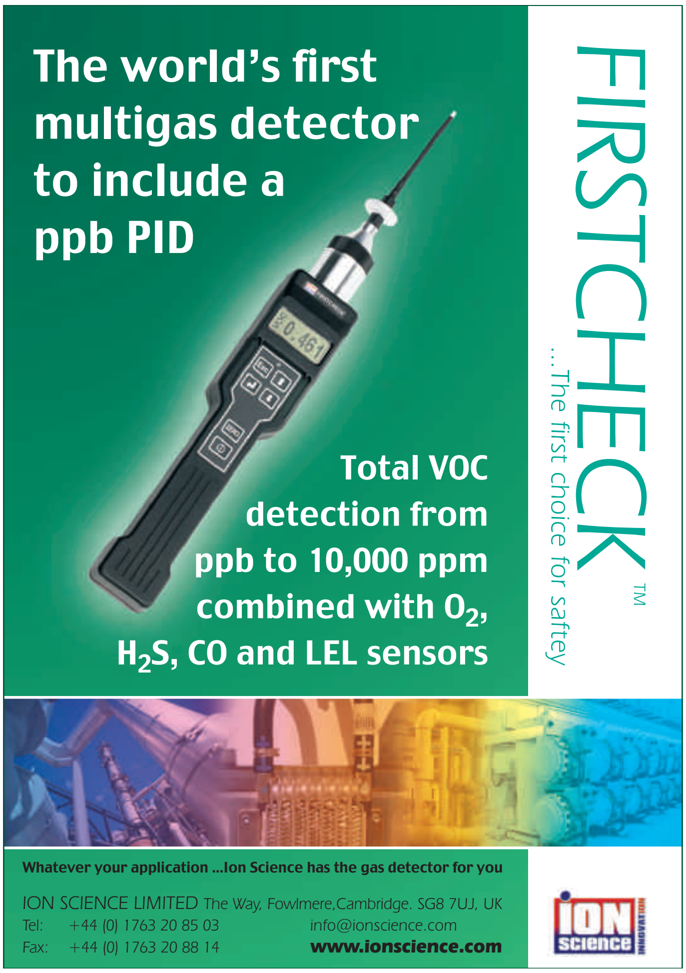

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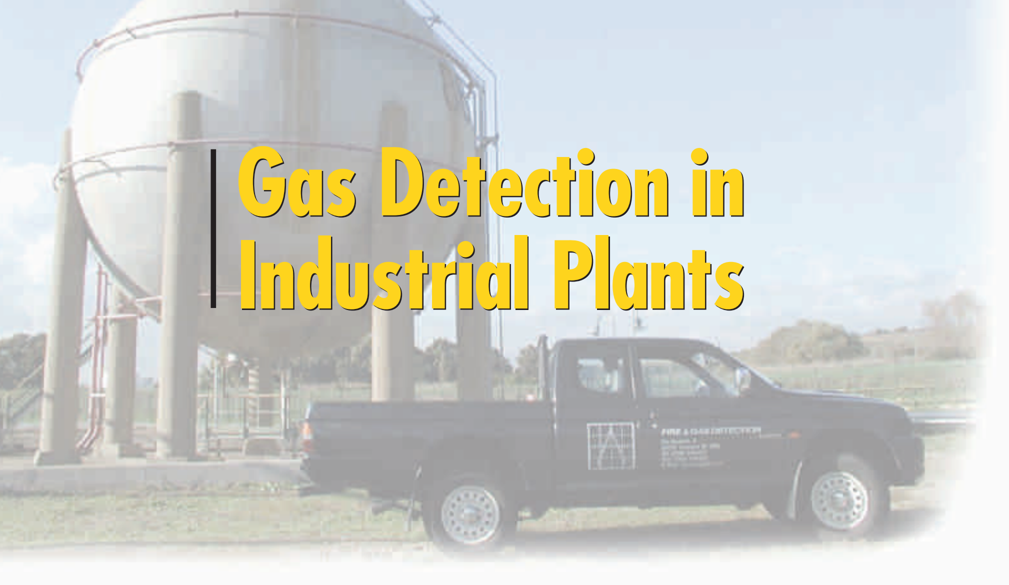

Gas Detection in Industrial Plants

Alarm output contacts or alarm signals shall be of a latching type requiring a manual acknowledge and reset.

The choice of a good and flexible modular system will permit to realize different hardware configuration, simplex or redundant with Fail save and fault tolerant characteristics.

Another important feature of the control unit is the capability to communicate via serial line with other systems as PC or DCS.

With modern information systems, planned maintenance can be easily performed to ensure that the gas detection system is maintained in full working order.

It will also be possible to use a management software to support the user both during all the operating and diagnostic phases, including programs for the test of each part of the plant, as well as of the sensors, the electrical wiring and the conditions of the actuators and alarm indicators.

This continuous monitoring of the system allows the automatic creation of a data log events; this has to be considered a powerful tool to better know the behaviour of the plant and workers during the different condition of the process.

All these information are essential to improve the safety of the plant allowing a rapid recognition of an abnormal event and permit to take a prompt remedial action preventing that the developing gas or vapour clouds could reach such a size to provoke a catastrophe.

Moreover the analysis of these data permits to identify the critical phases of the process as well as to recognize false alarms events.

This information constitutes also an excellent feedback for the corrective actions applicable to the process, or for the training of workers and for the improvement of maintenance operations.

Usually the detection range for the flammable gas is from 0 and the Lower Explosion Limit (LEL). 0–5% by volume in the case of methane but may be change in function of the different substances.

The explosive atmosphere is identified by the LEL and the UEL, the Upper Explosion Limit. Outside this range the mixture air and gas form a *potential explosive atmosphere*.

For the Toxic gases an indication for the detection range are reported from the occupational exposure standard limits, the long term exposure limit TWA, (8h Time-Weighted Average) and the short term exposure limit STEL (10 minute reference period).

With modern information systems, planned maintenance can be easily performed to ensure that the gas detection system is maintained in full working order.

Apart the different technologies employed for the construction of the sensors, the great difference between sensors for flammable gases and toxic gases are the sensibility, in the first case the range is expressed in % and in the second case in ppm, we have to remember that 1% = 10.000 ppm.

IN CONCLUSION

The technology allows an ample choice among various tools for the gas detection, the identification of the best solution for every specific case, must be found during the project phase, during which it has to be find the correct compromise between costs and benefit without forgetting that the goal for the system must be the safety and high reliability.

Marco Oggioni is the General Manager at Oggioni s.a.s. Company that designs and produces sensors for gas and fire detection.

He has been working in gas detection design, installation and manufacturing since over 15 years and is also the Technical Manager at Tecnos s.r.l. Company that supplies Fire & Gas systems for the main national and international companies.


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Automatic Sprinkler System Installation Reliability:

Dry Pipe Systems, MIC, Leaks and Corrosion

By Mark Hopkins, P.E.

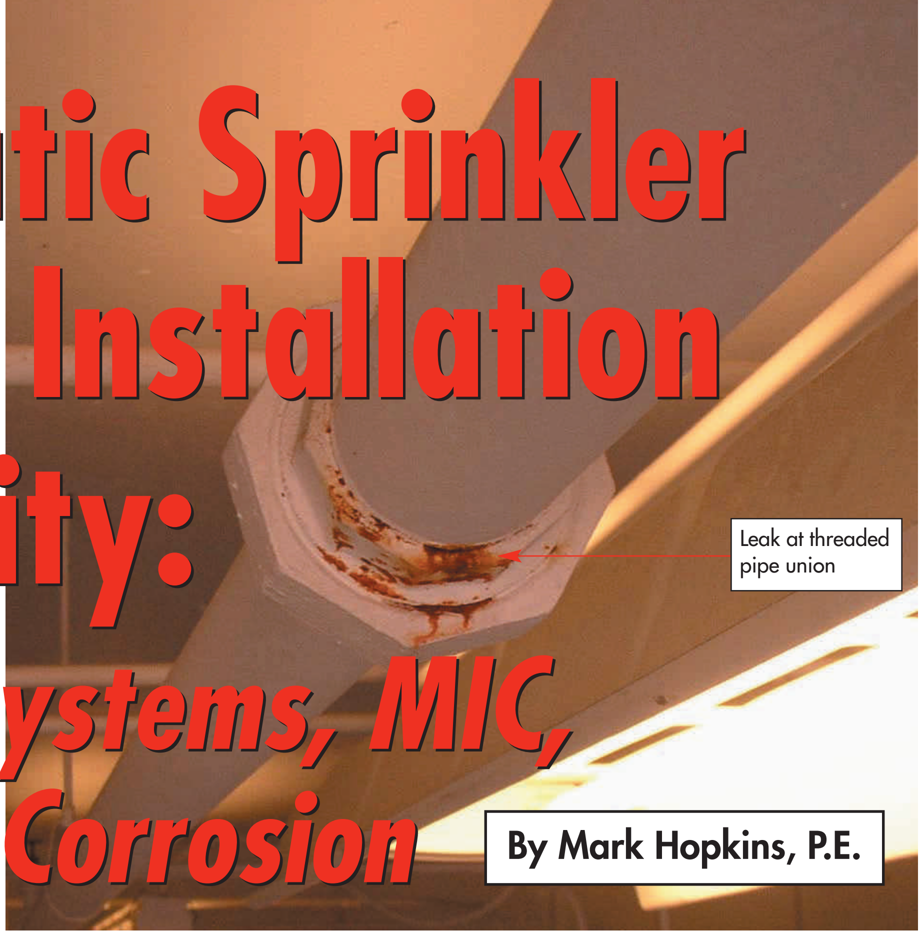

Figure 1. Leak observed on the exterior surface of a threaded pipe union

SPRINKLER SYSTEMS REMAIN DORMANT for long periods of time and these systems must perform as intended because lives and property are on the line. Once the systems operate they must deliver adequate water to control or suppress the fire. Requirements for the design and installation of sprinkler systems are found in NFPA 13, *Standard for the Installation of Sprinkler Systems.*[1] Requirements for inspection, testing and maintenance tasks are defined in NFPA 25, *Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems.*[2]

Budnick[3] identifies that the reliability of sprinkler systems can be measured in both terms of operation and performance. Operational reliability is a measure of the probability that the system or component will operate as intended when needed. Operational reliability elements are usually associated with inspection, testing and maintenance. Performance reliability is a measure of the adequacy of the system after it has operated. Performance reliability elements are associated with design, installation and maintenance.

The reliability of sprinkler systems includes four primary factors: design, equipment, installation and maintenance. When any of these factors are deficient, the system will inevitably prove unreliable and a failure will be observed. The failure could be observed in terms of a lack of response to fire conditions, operation without a fire, or an inability for the sprinkler system to control or suppress the fire. Budnick[3] identified that failures can be grouped into two categories failed-safe and failed-dangerous. Failures when no fire event has occurred are considered to be failed-safe and failures that involve components or systems when needed are considered to be failed-dangerous.

Many design and maintenance related factors influence the operational and performance reliability of sprinkler systems (e.g. choice of pipe, choice of sprinklers, configuration of system components, effects of corrosion, pipe sizing, hydraulic calculations). This

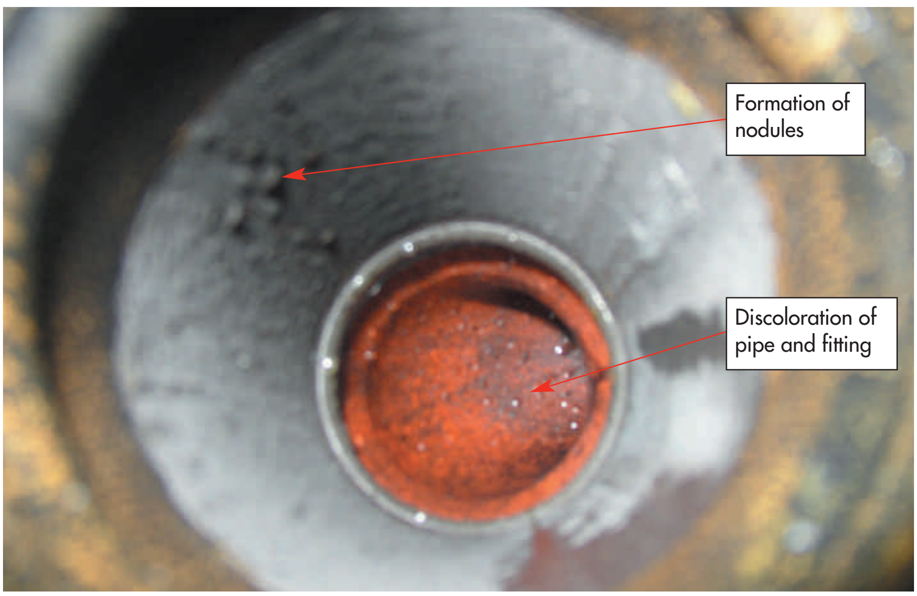

Figure 2. Section of pipe from the wet pipe system with minor corrosion

Figure 3. Interior surface of dry pipe valve

article focuses on a situation that involved the failure (failed-safe) of dry pipe sprinkler systems at a museum support facility.

Dry pipe and preaction sprinkler systems are often used when there is a concern for water damage to irreplaceable or high value items. Recently the occupants of a museum observed a number of pinhole leaks in the sprinkler system piping as well as leaks at both threaded and grooved pipe joints. The building is used for the storage and conservation of museum collections and is protected throughout with five (5) dry-pipe and one (1) wet-pipe sprinkler systems. The leaks were observed throughout the five dry-pipe systems and the single wet-pipe system.

The design philosophy behind installing dry pipe sprinkler systems in this facility was to provide protection against inadvertent water leakage and not to protect the system from damage due to freezing. The design intent was based on the incorrect assumption that any small leaks would cause a low-air pressure supervisory condition and result in an investigation to determine the cause of the leak prior to water leakage. However, dry-pipe sprinkler systems are subject to corrosion when small amounts of water remain within the pipes. As such, correct pipe pitch is essential when installing a dry-pipe system to minimize the potential for corrosion or freezing situations.

An investigation of the leaking sprinkler systems was performed to determine the cause of the corrosion and to provide specific recommendations for corrective action. The investigation included a series of tests and observations of both the interior and exterior surfaces of the sprinkler system piping. Random internal pipe examination locations were selected to determine the extent of the problem. Observations of the pipe exterior surfaces and the building environmental conditions were recorded for the areas surrounding the inspection points. Additionally, pipe samples were removed for metallurgical testing. Water samples previously taken from the systems tested positively for MIC.

Figure 1 is an example of a fitting that initially caught the attention of the building occupants. This photograph demonstrates the typical pattern of external staining and corrosion leading to the discovery of the problems with the sprinkler systems. It was indicated that during the repair of those leaks and similar leaks the contractor and maintenance staff observed a black slimy substance within the pipes, a telltale sign of MIC.

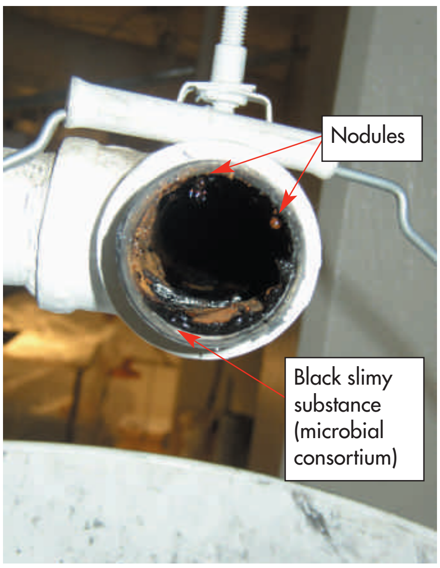

Figure 4. Interior surface of a branch line with signs of corrosion

The investigation of the wet-pipe sprinkler system demonstrated minor amounts of corrosion and no large quantities of slimy substances were observed. Figure 2 shows a section of pipe from the wet pipe system with minor indications of corrosion.

The investigation of the dry pipe systems resulted in different findings, however. Figure 3 shows the interior surface of a dry pipe valve with corrosion, heavy deposits and slime formation. Similar conditions have led to the failure of dry pipe valves under fire conditions (e.g. failed-dangerous).[3,4] Figure 4 shows the interior surface of a branch line with nodules and a black slime formation. These findings are positive indicators of MIC.

The investigation also revealed that the dry-pipe sprinkler systems were installed with improperly pitched pipes and did not allow water to drain back to the main (2-inch) drains. In fact, sections of the sprinkler systems were installed with pipes that pitched away from the main drain or that were essentially level. Low point drains were provided in some areas, but not in all required locations. NFPA 13[1] requires mains to have a back pitch of a ½ inch for every 10 feet pipe and branchlines to have a ½ inch of back pitch for every 10 feet of pipe. The sprinkler system pipes were installed without back pitch, similar to wet pipe sprinkler systems.

Figure 5 shows the interior surface of an improperly pitched main. The photograph shows residual water within the pipe, rusty/orange surface corrosion and nodules. Field tests also revealed additional positive indicators of MIC.

The installation of the pipes without proper back pitch resulted in trapped water throughout most areas of the sprinkler systems. The irony is that the dry pipe systems were installed to prevent water damage, but without the proper back-pitch for drainage the systems contained residual trapped water that resulted in severe corrosion and subsequent leaks. Compounding this

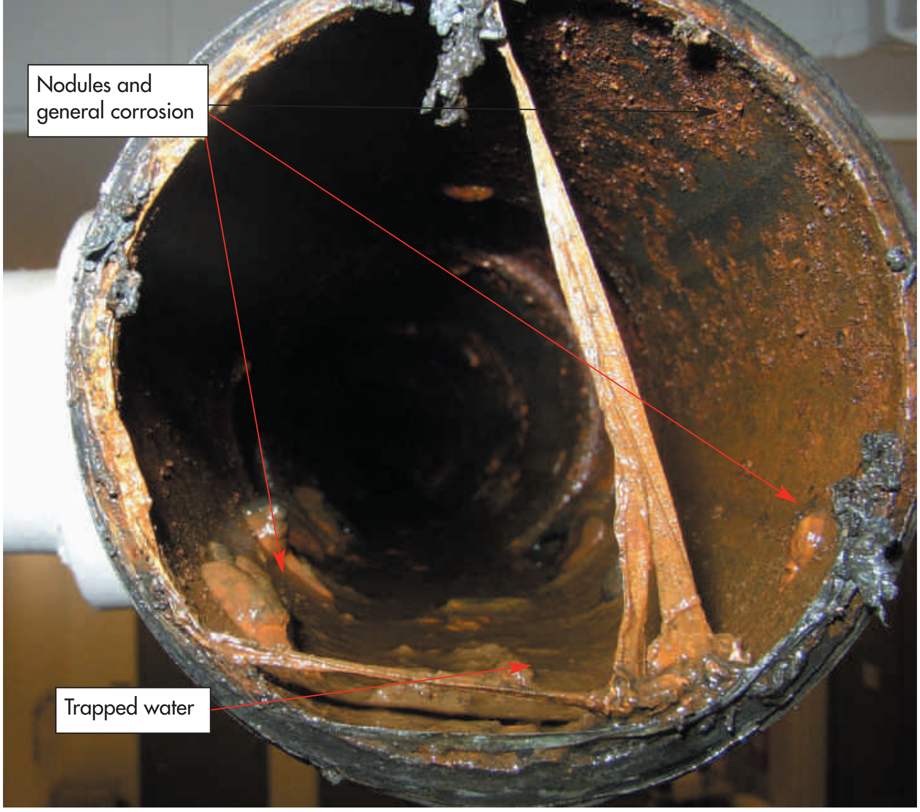

Figure 5. Interior surface of a dry pipe system main with corrosion and signs of MIC

problem, the water supply tested positive for microbes commonly associated with MIC (e.g. iron related bacteria, slime forming bacteria, low nutrient bacteria, and acid producing bacteria). The internal investigations of the dry sprinkler system piping also revealed signs of deposits, high iron content and orange, brown and black slimy substances. Field tests of the slurry mixtures and samples scraped from nodules within the pipes yielded positive signs of MIC, which reaffirmed the preliminary testing of the water samples.

Figure 6 shows a section of pipe from a dry pipe sprinkler system that was improperly pitched and retaining water. Notice the significant deposits of iron and the difference in the condition of this pipe section with the section from the wet pipe sprinkler system at the building (See Figure 2). The depositing in the pipes would lead to continued corrosion, but could also clog sprinklers or pipes.

The systems investigation revealed that the corrosion of the sprinkler systems was a direct result of the improper installation of the piping causing trapped residual water in the sprinkler system piping. The severity of the corrosion indicated that the sprinkler systems would continue to deteriorate if not treated. In this case the rate of corrosion was exacerbated by MIC, which was considered to be a contributing factor but not the root cause.

The sensitivity of the materials and operations within the building limited the possible solutions for correcting these problems. Flushing of the sprinkler system pipes and remediation of MIC by cleaning were considered to present a high risk of water damage to the collections. The risk of creating new leaks as a result of flushing and cleaning of the systems was not acceptable to the client. Therefore, the dry-pipe sprinkler systems were replaced with new wet-pipe sprinkler systems equipped with a corrosion inhibiting chemical injection system, automatic air relieving devices and corrosion monitoring stations.

The museum operators in this case made the right decision to provide complete automatic sprinkler protection for their valuable assets. They chose a dry-pipe system for the collections areas based on their concerns for potential water damage. The system was designed in accordance with NFPA 13 and to meet the museum's needs. However, the installation did not comply with the requirements of NFPA 13 and ultimately failed, once again proving the importance of design follow through and the need for construction oversight by the design engineer. Fortunately this failed system was discovered and replaced before it was called upon to control a fire, but at a significant cost.

Mark Hopkins, P.E., is with Hughes Associates, Inc.

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4. "Maintaining Dry-Pipe Sprinkler Systems: It's Crucial to Property Protection," *Plumbing Engineer*, March 2005.

Figure 6. Section of pipe from a dry pipe system with severe corrosion

TECHNOLOGY AND SAFETY

The fire-extinguishing agent **SACLON 2 ECO** is a mixture of colourless gases, that were skilfully mixed with a detossifying agent with scent of pine. The tanks are provided with rapid flux valves and the turned brass discharge nozzles are opportunely gauged for a rapid gas efflux in order to obtain the total discharge of the fire-extinguishing agent in a maximum time of 8/10 seconds. The action on fire of **SACLON 2 ECO** is to reduce in few seconds the oxigen percentage under the 14%, threshold under which fire can not survive. Thanks to its specific features it does not damage bronzes, plaster casts, pictures, clothes, tapestries and works of art, as it has no colour, no smell and it is not corrosive.

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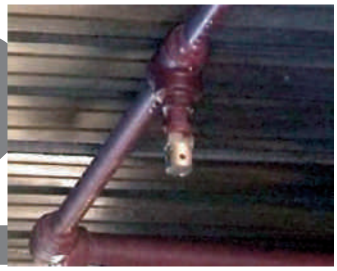
1

The pyre in pinewood, made in accordance to the UNI 10877 regulation, after being set on fire for three minutes and being let burning for three more minutes, is brought into the test-room in which there are the instruments for the survey of the data related to temperature and the percentage of oxigen in the various heights.

High pressure brass nozzles, appropriately gauged, guarantee the saturation of the environment in the maximum time of about 8/10 seconds.

2



3

The area is rapidly becoming saturated with **SACLON 2 ECO** and the fire on the wooden pyre is stiffling because of the reduction of oxigen.

The extinction took place and in the area the combustion's smokes and the extinguishing agent's rests are now circulating. The area should be abundantly aired.

4

5

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The product belongs to the fire-extinguishing agents included in the **E.P.A. REGULATIONS** (United States Environmental Protection Agency) and **NFPA 2001**, and thanks to its particular features it is suitable for the use for portable fire-extinguishers and in trolley fire-extinguishers.

The product passed brilliantly the test by the laboratory recognized by the **Italian Ministry of the Interior** as a total flooding fire-extinguishing agent to use in fixed automatical extinguishing systems, in accordance to the **REGULATION UNI 10877/1 "GAS FIRE-EXTINGUISHING SYSTEMS"**.

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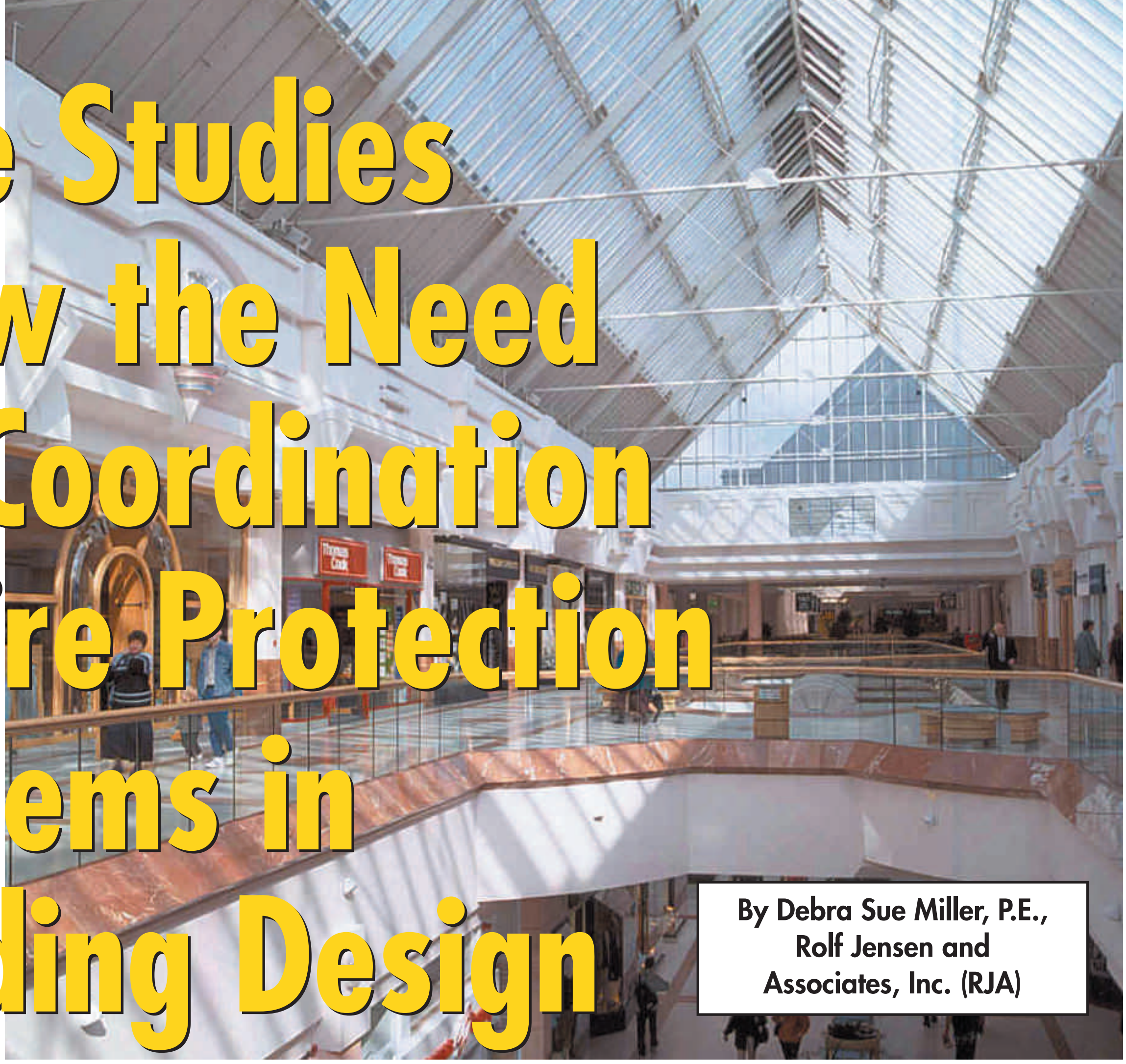
Case Studies Show the Need for Coordination of Fire Protection Systems in Building Design



By Debra Sue Miller, P.E., Rolf Jensen and Associates, Inc. (RJA)

Pic courtesy of SigNET (AC) Ltd

DO YOU EVER WONDER where fire protection is in the building design chain? Some case studies will be presented that highlight typical challenges in building construction projects that could have been minimized with better coordination and participation in the design process.

FIRE RESISTIVE RATED CONSTRUCTION

During the course of building inspections, we have all seen typical deficiencies in the integrity of fire resistive rated construction such as a non-rated door assembly installed in a fire rated barrier. The cost of correcting these deficiencies would have been reduced if identified during design meetings and document reviews. In the case of the non-rated door assemblies, coordination is needed between the architect and the fire protection specialist with follow up reviews of door and hardware schedules by the fire protection specialist to minimize overlooked door assemblies that are not specified to have a fire resistive rating.

Deficiencies identified during construction inspections of a six-story hospital facility included the following:

A. In one location a smoke barrier (1-hour fire rated wall construction) did not extend to the deck above the ceiling thru entire length of the wall below the ceiling. For a length of approximately two feet, the smoke barrier wall did not extend above the ceiling to the deck above. Reviewing smaller plans, it appeared that the wall was properly identified and scheduled as a 1-hour fire rated smoke barrier. However, on closer review of larger plans, the 1-hour fire rated smoke barrier identification terminated approximately two feet from the exterior of the building. Proper coordination during design would have addressed this issue. In the end, the 1-hour fire rated smoke barrier was extended to the deck above the ceiling.

B. To avoid conflict with a beam, a 2-hour fire rated barrier was not in the same vertical plane for the entire height of the wall. Therefore the wall included joints where it wrapped around one side of the beam. During the construction inspection, it was noted that one of the joints was not properly sealed. Upon further investigation, a section of the wall only had one layer of ⅝ inch gypsum wallboard and was therefore not of two hour fire rated construction. Coordination with the architect to insure the proper wall type was identified during design would have eliminated this deficiency.

C. The exposed structural steel had spray-applied fire resistive material. The application of the spray-applied fire resistive material occurred, as is typical, at a very early stage of the construction. Throughout the building, the spray-applied fire resistive material was removed to accommodate the top of wall framing and

Pic courtesy of SigNET (AC) Ltd

structural supports for various mechanical systems located above the ceiling. Coordination with the architect, structural engineer, and mechanical engineer could have minimized some of the conflicts. The inclusion of notes to the contractor in the design documents would have recognized the need for additional spray-applied fire resistive material or hand application of fire resistive material after work by wall framing and mechanical disciplines completed their work.

On a different project, this one a college laboratory building, an addition was being added. Due to the non-combustible non-rated construction type of the existing building and new addition, the addition needed to be treated as a separate building and a fire wall was required to separate the new building from the existing. This was necessary to meet the prescriptive requirements regarding type of construction. During a routine document review of the fire protection specialist, it was noted that the planned fire wall was not structurally self-supporting. The fire protection specialist coordinated with the architect to provide documentation including the details for building structural break-away from the wall on both sides and the required opening protection.

AUTOMATIC SPRINKLER SYSTEMS

Each fire protection specialist has noticed automatic sprinklers when they are too far from a wall or too far below a ceiling or deck in obstructed construction. On occasion, even a wall cut-out just for the sprinkler has been noted. This is a common coordination challenge which can be overcome by clear and concise design documents, review of contractor shop drawings and inspections by the fire protection specialist. Although it may be considered a design coordination challenge, the way to overcome it is the involvement of the fire protection specialist throughout the design and construction phases of a project.

Automatic sprinkler system deficiencies were also noted at the previously mentioned six-story hospital facility.

A. The system pressures for the lower levels of the building were greater than 100 psi gauge and less than 175 psi gauge. Therefore, in accordance with NFPA 13 "Installation of Sprinkler Systems", hanger assemblies supplying end sprinklers that are in the pendent position are required to prevent upward movement of the pipe. In the United States, this is typically either provided by clips or adjusting the hanger thread rod such that it is in contact with the steel pipe. During building inspections, the piping did not include anything to prevent this upward movement on any of the floors that had working pressures greater than 100 psi gauge. This was noted after ceiling installation which made it very difficult for the installing contractor to return and correct the deficiency, particularly in hard ceiling areas where there was only a minimum of access panels. This coordination issue is one of the easiest to address since it does not involve other disciplines. It is a prime example of the coordination and communication that must occur between the fire protection specialist or system specifier and the installing contractor.

B. This facility had the very common coordination challenge of additional sprinkler protection below obstructions such as ductwork in which the width of the obstruction exceeds four feet. This coordination challenge with the mechanical systems was expected but could have been minimized with proper communication between the fire protection specialist and mechanical engineer. By informing the fire protection specialist of changes in the ductwork sizes through the design phases, the identification of areas in the documentation to the installing contractor is provided and the areas of this type of deficiency would be minimized.

One of the most critical impacts of automatic sprinkler system coordination in buildings today is architectural features. Owners and architects typically want public areas of buildings to be open, provide a grand feeling and not show automatic sprinklers. This concept was critical on a university library project addition that included a new atrium entrance. The following design coordination challenges were encountered:

A. The atrium entrance included connections across the atrium. The architectural design was to paint the exposed concrete deck instead of having a ceiling system. This created a challenge since the space was too wide to be protected under the connections by horizontal sidewall sprinklers and the desire to not have exposed piping. In the end, the exposed piping was minimized by a carefully designed layout that incorporated trenches in the concrete deck for lighting to conceal sprinkler pipe in the center of the connections. To eliminate exposed piping between the trenched area and the sides of the exposed deck, the piping was sleeved in the concrete for lengths up to ten feet.

B. In the lobby area, initial designs included large ductwork above the suspended ceiling. During the design process, the concept changed to have ductwork serve as an architectural feature of the ceiling and be exposed for a partial depth below the ceiling. In order to provide required airflow, the ductwork had a width of more than four feet. Through coordination of the fire protection specialist, architect, and mechanical engineer, the sprinkler system was designed to minimize the exposure of piping and sprinklers to protect the areas under the ductwork.

C. Another challenge that was noted was the architectural use of ceiling pockets to increase the amount of light coming into the building. The ceiling height increased along the exterior wall for a certain distance before dropping down to a typical height for the building floor. This was prior to the addition of ceiling pocket allowances in NFPA 13. Just by reviewing reflected ceiling plan drawings, it is difficult to identify these pocket areas. In this library case, communication occurred between the architect and the fire protection specialist so adequate protection for the pocketed areas was provided without having to retrofit additional sprinklers based on construction inspections.

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D. The library chose to utilize mobile (compact) shelving in areas to optimize storage space for resources that were less frequently used. The mobile shelving systems chosen by the library had a height that would leave only a seven inch vertical space between the top of the storage and the ceiling assembly. The mobile shelving has a higher density of fuel loading than typical library stack areas. Considering the higher fuel loading and the small sprinkler clearance to the top of storage, special system layouts for the mobile shelving areas were required. With proper communication between the architect and fire protection specialist, the sprinkler system characteristics were able to be designed for the mobile shelving area without having to retrofit the system after the shelving was installed, which would have drastically increased the system cost.

When discussing typical sprinkler obstructions, systems protecting warehouses should be included. Regardless of the type of sprinkler system for a warehouse type space, coordination with the roof structure is a deficiency that is commonly overlooked. The typical roof structure for these types of buildings consists of exposed, unprotected steel beams, girders, and trusses. These structural components become sprinkler system obstructions. Coordination is needed between the fire protection specialist and the structural engineer. This is important for standard type sprinkler systems but becomes critical when utilizing Early Suppression Fast Response (ESFR) type sprinklers.

New technologies in all disciplines provide different options to the design of buildings. One of the newer technologies has been the machine roomless electric elevator. This electric driven elevator has the solid state control equipment located outside of the elevator enclosure, with all other equipment including the motor located within the elevator enclosure. This trend, particularly in the United States, eliminates square footage for machine rooms that can then be used as occupiable areas. Since equipment that acts as the elevator motor is physically located within the elevator enclosure, the shaft has been considered the machine room on several recent projects thereby requiring sprinkler protection at the top of the elevator

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enclosure which could have been omitted if a standard elevator system were used.

FIRE DETECTION AND ALARM SYSTEMS

During the course of the design and installation of fire detection and alarm systems, the most common coordination deficiency is related to visual notification appliances in conflict with wall hangings and shelving. In these cases the fire protection specialist must understand the use of the space and sometime even anticipate build-out features that the Owner will install after occupying the building. An example of this is meeting rooms that will have writing boards on a wall.

Fire detection and alarm system deficiencies were noted during the Third Party inspection of a fire detection and alarm system in a laboratory research building.

A. Laboratory style counters with open shelving were designed for each laboratory room. The contractor who installed the fire detection and alarm system utilized drawings that did not indicate the laboratory equipment and shelving arrangements within these rooms. Upon the Third Party inspection, it was noted that the shelving is full, visible notification throughout the room is not achieved. Therefore, additional devices, required in the laboratories. More costly than the additional devices themselves was the power draw with the subsequent need for additional battery back-up and additional space in the fire alarm communication spaces was needed. This impact could have been minimized if communication and coordination occurred between the laboratory system designer and a fire protection specialist during the design process.

B. The laboratory air handling configuration incorporated air provided to the corridors that would maintain the laboratory rooms at a negative pressure to the corridor. The corridor was also provided with open plenum return above the ceiling. During construction, the fire detection and alarm system contractor installed the corridor smoke detection prior to the suspended ceiling tile installation. During the Third Party inspection, smoke detectors were located within three feet of air handling system grills in the ceiling. Smoke detectors had to be relocated and additional smoke detectors provided to meet the requirements of NFPA 72 "National Fire Alarm Code". Proper communication and coordination between the mechanical engineer and the fire protection specialist during design would have minimized the number of smoke detector locations that were impacted by the air handling system.

Other typical fire detection and alarm coordination deficiencies arise from interfacing the fire detection and alarm system with other building systems. Examples of this include:

A. Coordination with the mechanical engineer for duct type smoke detectors that interface with air handling unit shut down and the closing of smoke dampers.

B. Coordination with the electrical engineer for fire alarm system power requirements during normal operations and when on an emergency generator.

C. Coordination with the mechanical engineer for smoke control systems. This includes proper sequence of operation including dampers.

D. Coordination with the security consultants to unlock specific doors in an emergency situation.

E. Coordination with the elevator consultants to insure proper recall and power shunt trip operations.

The last critical coordination challenge discussed here is the use of new equipment and it's networking with existing equipment. This challenge is typically noted in multiple building complexes such as university campuses and large hospital complexes. This was the case for the above mentioned six story hospital building being constructed on a hospital campus. Early communication including the Owner and fire alarm contractor was not adequate. The Owner had several buildings varying in age and wanted to network all the building fire alarm panels. The fire alarm contractor indicated it could be done with what was at that time new system technology which had not yet been fully tested for a campus application. This was not clearly identified until the Third Party inspection. In the end, fire alarm system upgrades were needed in the existing buildings to provide the functional capability that the Owner desired.

A THOUGHT TO LEAVE YOU WITH

Every fire protection specialist has their lessons learned. The above are only a few examples to demonstrate how critical and cost effective communication and coordination is between design disciplines.

Ms. Debra Miller is a Consulting Engineer with the fire protection engineering firm Rolf Jensen & Associates, Inc. (RJA). Located in their Houston, Texas USA office, Ms. Miller's experience with RJA includes preparing code evaluations, fire protection and life safety reports, and exit analysis for projects using the major model building codes. To learn more about RJA, visit their website at www.rjainc.com


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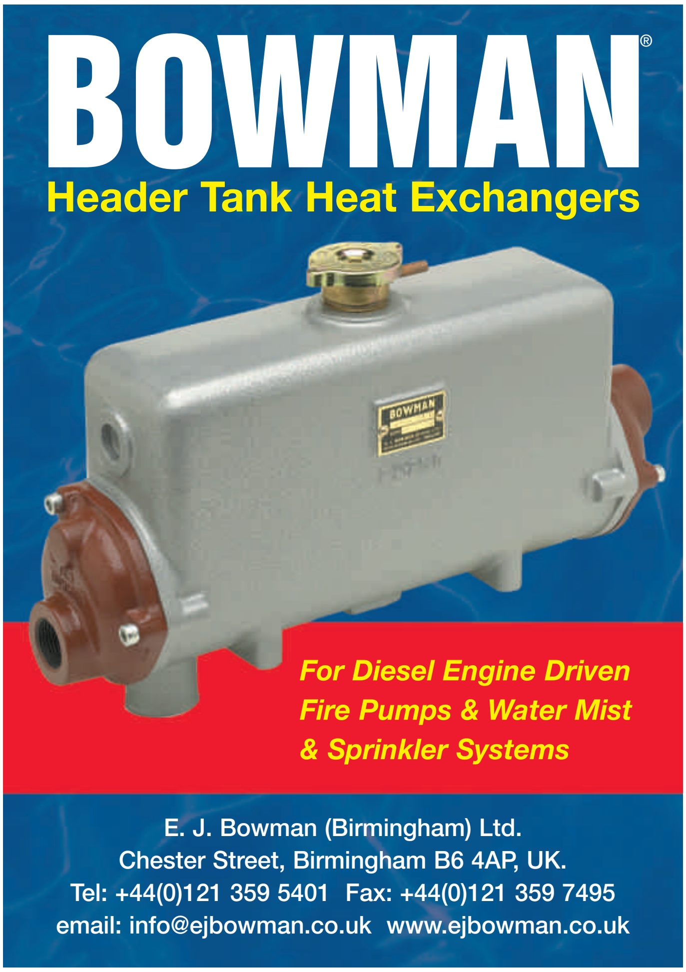
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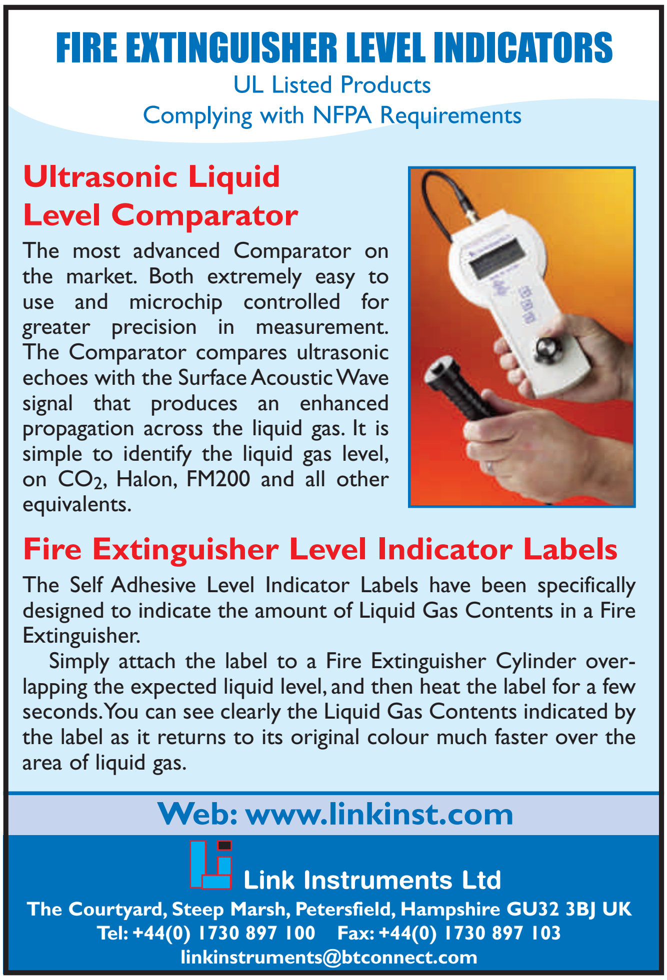
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Fire Protection of Structural

By Ian Stewart – Fire Protection Sales Manager

WHEN DESIGNING A STRUCTURAL steel frame for an airport project a consideration of the type of passive fire protection to provide the required fire resistance can be critical to the construction process.

In this article we look at the use of intumescent coatings for structural steel fire protection on three major airport projects. Each project presents different challenges which the construction teams had to address in order to deliver certified and approved passive fire protection, within budget; completed within programme; with good appearance and with a life to first maintenance to meet the clients requirements.

Specification of the intumescent coating system:

- Surface preparation
- Primer (where necessary)
- Intumescent coating
- Top coat (where necessary)

The selection of each component must be specific to the needs of the project in question and must be considered for compatibilty with the other elements of the coating system.

The environment in which it will be exposed, where it will be applied and the decorative requirements of the system will determine the specification of the system.

The merits of off-site intumescent application versus on-site intumescent application have to be carefully evaluated.

HEATHROW AIRPORT T5, LONDON, UK

On the Concourse A development all the energy centre main power units, utility tunnels, main air handling units, IT units and chimneystack units are being built into prefabricated stacking modules. There are up to 200 modules in total for this phase of the project. This method was adopted as a faster more cost effective solution than fitting out on-site.

The selection of each component must be specific to the needs of the project in question and must be considered for compatibilty with the other elements of the coating system.

Ameron International is supplying the corrosion protection coatings and finish coatings for the modular structural steel. The air handling modules had the additional requirement of needing 60 minutes fire resistance.

The option was to use cementitious or intumescent fire protection on the steel. Due to the close proximity of the various pipes, cables and switchgear to the steelwork and the damage risk with the use of cementitious fire protection, it was decided to use thin film intumescent coatings.

The structural steel module frames are up to 8m long, 4m high and 4m wide. The corrosion protection system was selected to allow the incorporation of a pre-fabrication primer based on a fast drying inorganic zinc single pack followed by a 2-pack epoxy primer after fabrication and welding.

An external grade fast drying intumescent coating for offsite application was used to fire protect the structural steel frame. A good overall finish appearance was achieved by using a grey tinted intumescent coating as opposed to off-white. The modules will eventually be in an internal dry heated environment, so no topcoat is required. This means the intumescent coating must be able to resist external exposure for up to 12 months prior to the building being weather tight.

Steel on Airport Structures

The modules may be subject to some transport and erection damage, which will be repaired on site using an intumescent repair filler.

SOFIA AIRPORT, SOFIA, BULGARIA

The eye catching roof design of the new terminal building at Sofia airport utilises tubular steel in an elegant curved design.

The fire resistance period was 60 minutes and 90 minutes on the steel frame structure in accordance with local building codes.

The visual appearance of the steel being of high importance it was the only option to use intumescent coatings on this project.

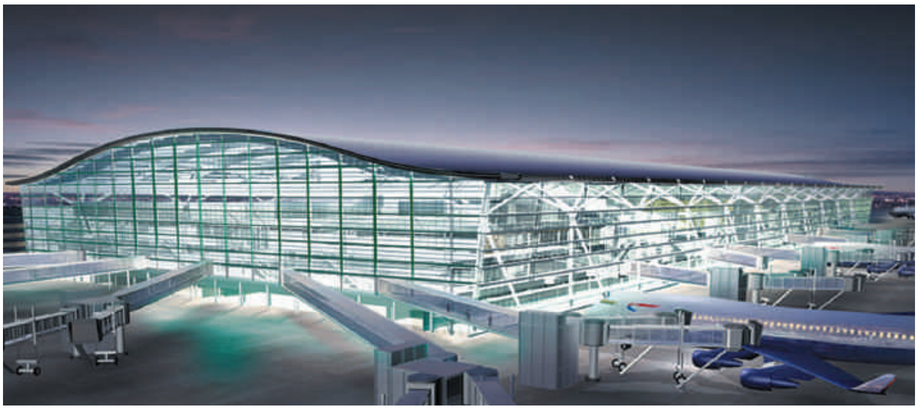
The construction team considered offsite versus onsite application of the intumescent coatings for the steel frame and decided to go for offsite application. The reason was that due to its complexity, a better quality of finish could be achieved by applying the intumescent coating offsite. On tubular steel to get a good finish, access is all-important and this would have been very difficult to achieve onsite.

One particular circular hollow section of steel was of such low mass per linear metre that it could not be fire protected without filling it with concrete. This was an unexpected problem for the construction team. Concrete filling reduces the A/V of the steel section. The A/V ratio determines how much thickness of intumescent paint is required to fire protect the steel. Without concrete filling, which had to be verified by assessment from Warrington Fire Research it would not have been possible to fire protect this tubular section.

The steel was finished in a white colour using a durable acrylated rubber topcoat from Ameron in a one-coat application.

DUBAI AIRPORT HANGER PROJECT, DUBAI, UAE

The Dubai airport hanger project presented many challenges to the construction team. It being one of the largest aircraft hangers ever constructed. The steel frame for the 8 aircraft hangers



being 35m high with a span of 100m for each hanger. The middle of the structure being workshops and administration buildings. The environmental conditions at site meant that the ambient steel surface temperature was around 40°C with a risk of high humidity at certain times of the year.

A good visual appearance of the visable steel frame was essential so intumescent coatings were selected. Concealed steelwork in the workshops and administration areas were fire protected with cementitious fire protection.

The construction team considered onsite versus offsite application for the intumescent coatings. They decided onsite application was the best solution for many reasons.

Firstly the columns had to have 2-hour fire resistance, which would mean an intumescent thickness in excess of 2mm. At this thickness offsite application becomes impractical due to drying times being extended.

The volume of steel was up to 25,000 tons and the fabricator did not have the lay down area to coat the steel and let it dry. The potential for damage to the offsite application was considered a major cause for concern. Site lay down damage and erection damage were considered too high a risk.

The columns required 2 hours and the roof structure 60 minutes fire resistance. The project selected an external grade intumescent coating from Ameron, which was tested and approved to meet local standards.

The environment for the Dubai hanger project was considered as C2 in accordance with ISO 12944 Part 2. Third party testing to verify fire performance after extended weathering is very important on major projects. Ameron have third party certification to verify performance to the BS8202 Part 2 code of practise for durability and fire testing of intumescent coatings from independent laboratories.

The onsite application is nearly complete and a topcoat of acrylated rubber from Ameron in a grey shade makes a good decorative finish, which also protects the intumescent coating from high humidity.

Other airport projects Ameron BV was involved in are amongst other:

- East Midlands, UK 1995
- London Heathrow T2, UK 1996
- Sofia Airport, Bulgaria 2002
- Balice Airport, Poland 2003
- Heathrow T5, UK 2004
- Porto Airport, Spain 2004
- Sofia Airport, Bulgaria 2004
- Dubai Hangar, UAE 2005

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or visit our website: www.ameron-bv.com

Flashover in

By Clifford Jones

Pic courtesy of Washington Hall International Training and Development centre

IMAGINE THAT IN AN enclosed space such as a classroom one flammable object, such as a piece of soft furnishing or a shelf of books, in isolation from other easily ignitable material catches fire. For a period the fire will burn in a localised and fairly steady way. During this time there might well be measures taken to control the fire, perhaps using a portable extinguisaher or sprinklers. If however no such measures are taken one of two things will happen:

(i) The fire will continue until all of the available fuel is used up and then die out.

(ii) A point will be reached where the heat-release rate is sufficient for the fire rapidly to transform from a small one to one involving the whole room, with an accompanying large increase in the total heat-release rate. This is the phenomenon of flashover. It is frequently observed in accidental fires and is well known to fire fighters.

The fire protection engineer needs to be able to make predictive calculations of flashover as part of risk analysis. We shall attempt a number of such calculations in this article but first some points about flashover will be discussed.

THE PHENOMENOLOGY OF FLASHOVER

As already described, it is the very sudden change of fire behaviour from being small and localised to involvement of the whole enclosure. 'Sudden' means too quick for any emergency responses to take effect or even be initiated. A widely used rule of thumb is that a fire will flash over if and when its total heat release exceeds 1 MW (megawatt, 10^6 watt). This is probably a conservative criterion erring if at all on the safe side, which makes it suitable for risk calculations. It is believed that in some fatal fires flashover has actually taken place at closer to 5 MW.

Expressing the flashover criterion so simply is useful in fire protection engineering, but one needs also to understand the inter-related events in flashover. As the initially small ('pre-flashover') fire takes its course it slowly warms the surroundings. Heat transfer from fire to surroundings is consequently reduced and this accelerates the fire, making the attainment of 1 MW more likely. Deposition of soot on to the walls and ceilings makes them more emissive towards thermal radiation some of which finds its way back to the pre-flashover fire and again accelerates it. At flashover, heat transfer from the fire to the surroundings is both conductive and radiative. The radiative component is due to carbon dioxide and water in the burnt gas.

A point that the author has recently made elsewhere is that there has to be something to flash over *to* which is why flashover is limited to enclosure fires. A car, even a very small one, having ignited through petrol tank rupture in a collision will certainly release heat at a rate in excess of 1 MW but if the car is out of doors there cannot be flashover.

Times to flashover are important in fire protection engineering. For example, the time to flashover needs to be compared with the time for evacuation of the enclosure in which a pre-flashover fire is taking place. We return to this point later in the article.

TWO SIMPLE PREDICTIVE CALCULATIONS OF PROPENSITY TO FLASHOVER

Let us first consider the hypothetical though totally realistic example in

A widely used rule of thumb is that a fire will flash over if and when its total heat release exceeds 1 MW (megawatt, 10^6 watt).

enclosure fires

Pic courtesy of Washington Hall International Training and Development centre

the boxed area below.

What practical value would the calculation above be put to? The workshop would specify to the supplier of solvent the dimension of drum required. If there was ignition of the contents of such a drum and they were allowed to burn out completely – a 'worst case' – there would not flashover.

A calculation such as the above might, in a forensic application, need to be done in reverse, that is, a fire at the workshop in which there has been flashover is being followed up. It is noted from examination of the debris that a drum containing the solvent had ignited and a judgement has to be made as to whether this caused flashover or whether its ignition was a post-flashover event. If the drum diameter was 2 m that would suggest that the solvent fire did cause flashover. If the drum diameter was 25 cm it could reasonably be concluded that it did not in which case, given that flashover had occurred, some other origin of the pre-flashover fire (e.g., malfunctioning electrical power supply) has to be identified. If the drum diameter was somewhere in the range 50 cm to 1 m the calculation in the box would not be sufficient for an unequivocal conclusion to be reached and the approximations and assumptions made in the calculation might have to be examined more closely to provide a more precise end result.

Secondly, we consider a fire of electrical origin. In today's world buildings contain vast lengths of cables for IT and other purposes and these can of course be a source of fire. Such cables carry only small currents in contrast, for example, to cables supplying power to heavy machinery. Even so, fire in a cabinet occupied by cables bearing only low current is possible if a high resistance due to a faulty connection develops over a short length of a circuit as this will provide an electrical hot spot from which ignition can result. Flashover conditions for such a situation have been discussed in the recent literature[1] and a criterion for flashover expressed in terms of the ventilation conditions. More usefully for the purpose of this discussion a temperature at which an electronic cabinet will if ignited flash over is given and this can be the basis of a calculation analogous to the previous one for a drum of solvent. This is in the boxed area on page 86.

Again one might err on the side of caution by recommending say 4.5 m dimension. The calculation has already erred on the side of caution in taking the emissivity to be one – the definition of a black body – when it might be a little less. Approximating a flame to a radiator at a single temperature is called the 'solid flame model' and is common in hydrocarbon technology. A full critique of the solid flame model is outside the scope of this article but one point does need to be made clear

A workshop uses a solvent for cleaning purposes. The solvent is an oxygenated hydrocarbon the flash point of which is below room temperature. It is supplied in small drums the lids of which sometimes have to be removed leaving the liquid surface exposed. It is reasoned for planning and insurance purposes that the diameter of the drum must be such that were the vapour above the exposed liquid surface to ignite the total rate of heat release must be less than the flashover value of 1 MW. What is the maximum allowable drum diameter? If the height of the drum is twice the diameter what volume of the solvent will one drum hold?

Solution:

Ignition of the vapour would of course lead to a pool fire, and another rule of thumb in fire protection engineering is that hydrocarbon pool fires burn at a rate of about 0.1 kg $m^{-2}s^{-1}$. We saw in an earlier article in this series that oxygenated hydrocarbon compounds such as aldehydes and alcohols have calorific values in the region of 25 MJ kg^{-1}. So letting the maximum diameter be d metres:

$$10^6 W = 0.1\ kg\ m^{-2}s^{-1} \times 25 \times 10^6\ J\ kg^{-1} \times (\pi d^2/4)\ m^2 \Rightarrow d = \underline{0.71\ m}\ \underline{(71\ cm)}$$

$$\text{Quantity in 1 drum} = \pi \times (0.355^2) \times 1.42\ m^3 = \underline{0.562\ m^3}\ \underline{(562\ \text{litre})}$$

The calculation is based on the minimum requirement for flashover. Building in a 20% safety margin, advice might be given that a 60 cm diameter drum should be used in which case, with the height-to-diameter relationship previous stated, the drum would hold <u>330 litre</u> of the solvent.

Pic courtesy of Washington Hall International Training and Development centre

to all readers: *treating the flame as a radiator is not equivalent to assuming that all of the heat transfer from the flame is by radiation to the exclusion of convection.* On the contrary, probably only about 20-30% is actually transferred by radiation. Readers sufficiently interested will find a fuller discussion of this point in one of the major combustion texts.

According to the source cited in the footnote, an electronic cabinet having ignited will flash over when the temperature is about 660°C. Such a cabinet is to be installed in a room and mounted on a wall. Its front surface, a transparent screen, is to be square and its area is the effective area of the cabinet for heat transfer purposes as the wall at the back is heavily insulating and the width of the cabinet perpendicular to the wall is negligible in comparison with that of the transparent screen.

What is the maximum dimension of the screen which will ensure that if there is ignition of the contents of the cabinet there will not be flashover to the entire room?

Solution:

We treat the burning cabinet as a black body at 660°C (933 K) and we take 1 MW to be the heat-release rate for flashover, whereupon:

$$10^6 W = (\sigma\ W\ m^{-2} K^{-4}) \times A \times T^4$$

where σ is the Stefan-Boltzmann constant (5.7×10^{-8} W $m^{-2}K^{-4}$), A the area and T the absolute temperature. Inserting the numbers:

$$A = 23\ m^2$$

So of the screen is square one side has dimension <u>4.8 m</u>

TIMES TO FLASHOVER

When flashover does occur it will not be immediate. The pre-flashover fire will take some time to reach the heat-release rate required for flashover and this has some dependence on the rate of warming of the surroundings as noted. A great deal is known about 'development times' of fires in various sources through applications of calorimetry in its several forms, and reliable plots of heat-release rate as a function of time have been obtained for such things as television sets, personal computers, household fittings and furnishings and motor vehicles. The specialist literature including the

Pic courtesy of Washington Hall International Training and Development centre

monumental 'Ignition Handbook' by V. Babrauakas (Fire Science Press and SFPE, 2003) can be consulted for details. There are also established correlations, to be found for example in successive editions of the SFPE Handbook, for movement of persons in response to a fire and the dependence of this on the number of exits and their width. The room can be equipped with exit facilities such that times to flashover are large in comparison with exit times.

CONCLUDING REMARKS

This article has attempted to explain flashover and given two simple examples of fire hazard calculations involving prediction of flashover conditions. An earlier issue of this periodical was concerned with fire safety at airport terminals. About 7 years ago there was some concern about fire safety at the new international airport in Hong Kong, there being suggestions in the open literature that a small fire starting perhaps in a retail outlet could flash over to the entire terminal hall. There was an immediate response from one of the fire protection engineers who had been involved in the design and construction of the airport[2]. In the fire management of any facility flashover is a factor which has to be noted and examined by calculations of the genre of those in this article with some refinement where necessary.

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2. Beever P. Journal of Fire Sciences 16 151-153 (1998)

Dr. J.C. Jones of the Department of Engineering, University of Aberdeen, has 25+ years' experience in thermal matters. He has held academic posts in Australia as well as in the UK and has written six books and over 200 research articles. He has acted as consultant to a number of chemicals producers and also to the Police Arson Squad. He has lectured on his work in places including the US, South Africa, Spain, Sweden. Hong Kong, Thailand and India.

Carbon Dioxide (

Fire Extingui

CARBON DIOXIDE (CO_2) HAS BEEN used as a fire-extinguishing agent in fixed fire protection systems for over 90 years.

It is a naturally occurring gas, which is extracted from a number of normal CO_2 producing processes and stored until needed, (thus there is a net removal of CO_2 from the environment, when used in fire suppression systems). The costs involved in capturing, storing, and distributing CO_2 are also minimized as they are spread over a wide range of other common uses, the most recognizable being beverage carbonation.

By B. G. Bischoff, Senior Consultant, Chemetron Fire Systems

As a gas it has a three-dimensional fire-fighting characteristic. In addition, it is inert, dry and leaves no residue after system discharge. It can be compressed into a liquid state which, when maintained under pressure, allows a more efficient storage than other inert gases such as nitrogen and argon.

From a fire suppression stand point the most important characteristic of CO_2 is that when it is discharged, and the pressure drops, a significant portion of the CO_2 'flashes' into fine particles of solid CO_2 ('dry ice'.) As the dry ice particles sublime (change from solid to gas), the inerting characteristic of the CO_2 discharge and a limited amount of localized cooling provides for fire extinguishment. The dry ice particles can be projected over much greater distances than would be possible with a vapor (gas only). The almost instantaneous phase changes from stored liquid, to solid dry ice discharging from the system piping, to the CO_2 vapor (in very effective fire extinguishment capabilities) make carbon dioxide equal to none when being compared to other gaseous extinguishing agents.

It is also possible to create CO_2 discharge patterns, which, even without benefit of enclosing walls, can envelop the protected equipment in case of fire and offer quick, clean suppression, minimizing any interruption to vital operations or processes.

While, the flooding (inerting) characteristic of CO_2 ("total flooding") defines its use in enclosed spaces, the enveloping localized discharge ("local application") defines its use for unenclosed equipment protection. The versatility of applications is what gives CO_2 its true uniqueness.

There is a negative side to CO_2 use when compared to the other "clean" fire suppression agents available on the market today. The discharge of carbon dioxide in fire extinguishing concentrations creates serious hazards to personnel, including the possibility of death by suffocation during and after the discharge. Thus CO_2 should never be considered for use as a total flooding type system in any areas that are normally occupied by personnel. Suitable safeguards should be provided to ensure prompt evacuations prior to use of CO_2 and prevention of entry into areas that CO_2 has been discharged or has migrated. In addition, appropriate system hardware (system lockouts) should be provided to prevent accidental or deliberate discharges during system maintenance or when persons not familiar with the systems and their operation are present in the protected space. The National Fire Protection Association, has been publishing a standard on carbon dioxide extinguishing systems (NFPA 12) for over seventy years with well-defined safety requirements. The majority, if not all, accidents associated with CO_2 occurred because the individuals, charged with the use, installation and/or maintenance of carbon dioxide systems, were not properly trained to work on and in the vicinity of the systems.

To provide a better understanding of how CO_2 can be used in some actual, yet unique, applications, the following examples are offered:

COLOR PRINTING PRESSES

In the production of packaging material, bold, attractive colors have been found to attract buyers. The packaging material is produced on Rotogravure or Flexographic Presses that do high quality printing on continuous sheets of paper, film or foil. These presses are often coupled with Laminators which 'sandwich' the printed-paper, film or foil together to give the packaging its appeal and strength. In the printing or laminating process it is often necessary to use solvent based inks and/or adhesives to give the desired results. Many of the inks and adhesives used are flammable and create a significant fire hazard that must be protected against.

Solvent-based ink is either pumped from a central ink storage location or a smaller ink supply can be located at the printer. From the location of the supply the ink is piped to a shallow pan (or font) with a roller, which picks up the ink from the pan and applies it to an impression roller. The roller applies the ink or adhesive to the surface of the material being printed/coated. The primary fire hazard is the ink/solvent with its accompanying vapors.

After the sheet material is printed or coated it is dried by threading it through an oven(s) where additional vapors from the ink are released. These dryers are part of the total fire hazard. At the same time, in the printing process, vapors are released at the printer fonts, which are drawn up into exhaust ducts for removal from the processing area.

It is extremely important that the total hazard be protected. Good fire protection practice dictates that anything that can lead a fire into a hazard area or that can extend it out from the primary fire area should be protected as a part of the "hazard". Obviously, this should also include potential spills. At the printer/laminator ink supply the potential for a spill on the floor, as well as the exposure of the ink reservoirs at each press, expands the size of the hazard.

The flexibility of CO_2 system design and having the capability to be versatile in the application of CO_2 allows for good, efficient fire protection.

(CO$_2$) – A Unique ...ishing Agent

Since the fonts with rollers and pans are not enclosed we must use "local application". Fortunately, local application CO_2 systems have a wide variety of nozzles which can be located so that each can discharge to cover its assigned part of the hazard such that it will not splash or spread burning material and yet the nozzles and system piping can still be located so as not to interfere with the material handling equipment at the press and the need for equipment removal for cleaning and maintenance. The ink supplies and the spill areas will also need "local application" protection.

In addition to locally applying CO_2 in the inking area we need to "total flood" the vapor exhaust ducts and the dryer with CO_2.

Each segment of the total hazard can be protected properly while still applying CO_2 in a different manner, however; only one CO_2 system needs to be provided to protect the "total" hazard.

DUCTS AND VAPOR/DUST COLLECTION SYSTEMS

With renewed interest in air quality and regulatory efforts to ensure the same, it is most important to ensure that hazardous vapors and dust be collected and not allowed to enter the environment. When these materials are flammable or combustible, there is an ever-present potential for fire. In many installations there is also a build-up of combustibles on the inside of the ducts conveying vapors or dust further increasing the hazard and increasing the need for fire suppression requirements.

If a fire should occur, locating and controlling the fire before it can cause serious damage is imperative, but not easy. In addition to potential property damage, the loss of the use of the vital collection system will shutdown the process with a potentially serious impact on plant operations. The use of CO_2 to protect these units has worked out extremely well.

As a gas, CO_2 can be injected into the ductwork and collector(s) in such a way that the entire system is inerted and fires suppressed. NFPA 12 "Standard on Carbon dioxide extinguishing Systems" has contained design criteria for duct and collector protection for years. The specified requirements have resulted in systems fairly easy to design when CO_2 is used. Discharge nozzles and piping networks can be easily calculated ensuring that a system, no matter how complex, will deliver the required gas where needed and in the required quantities to ensure fire suppression throughout the collection system. As an added bonus, it will leave the ducts and collector(s) dry, facilitating a quick return to service. Coupled with current detection technology, fast operation in case of fire is assured.

COMBUSTION TURBINE AND ENGINE ENCLOSURES

When considering CO_2 protection of combustion (gas) turbines and engines within an enclosure, the first determination is what combustible is to be used as the basis for the CO_2 design concentration. Fuel oil and Lube oil requires 34% design concentration of CO_2 while natural gas requires a 37% design concentration. Since it is imperative that CO_2 be maintained at design concentration or higher in hazard space long enough to extinguish a fire, there should be an analysis to determine how long it will take for a turbine to wind down to a stop, after the unit has been shutdown. There is also a concern as to the temperature of the exposed metal surfaces and how long the surfaces will take to cool down after unit shutdown. This information is generally available from the manufacturer, or field measurement will be required. The turbine information, along with the volume and configuration of the compartments to be protected, can be used to calculate the initial discharge quantity of CO_2 required for protection. In addition, data must be collected (usually by testing) to determine the CO_2 loss rates from the protected compartments during the wind down period of the unit. (As a turbine winds down to a stop, fresh air is being drawn or forced into the compartments and forcing the initial concentration of CO_2 out.) This information is used to determine the extended CO_2 discharge rate needed to maintain the CO_2 design concentration during the run down/cool down time period.

The result is that the fire suppression system design is based on the parameters as defined for the operation of the turbine. NFPA Standard #12 requires a full CO_2 system discharge test be performed on every installed system. This will positively indicate if the extended discharge provided will be capable to meet the requirements of the fire suppression design necessary to protect the turbine for the entire time period.

Over the years, halocarbon systems have been used for initial flooding but very rarely with an extended discharge. Fire experience has demonstrated the need for full-extended discharge protection as stated in NFPA Standard #37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines) Para. 11.4.4 (i.e. design based on specific combustibles present and specific configuration of enclosure plus holding the design concentration for a minimum of 20 minutes or until the engine surfaces have cooled).

Design of extended discharge systems are normal when using CO_2 but are usually avoided when using halocarbons due to significant cost increases. The overall history of success with CO_2 vs. numerous failures with other gaseous agents, has firmly established CO_2 as the preferred agent for gaseous agent protection of Gas Turbines.

SUMMARY

In summary, regardless of the growing numbers of extinguishing agents used for fire suppression, carbon dioxide systems continue to be one of the best, most effective and most versatile suppression systems available on the market today. Above we have provided a brief overview of three unique, yet common CO_2 fire suppression system applications used throughout the world. A more accurate statement would be "a brief overview of only three applications of a collection of way too many to list in any one document.

Class K Fires – a for Commercial

FIRES INVOLVING COOKING MEDIA (grease, fats and oils) have long been a cause of property loss, injury and death. These fires are very special in nature. Recent tests by ULI (Underwriters Laboratories, Inc.) and other agencies around the world have given us new insights into this unique fire hazard.

By J. Craig Voelkert
Vice President
Special Hazards
Amerex Corporation

THE UNIQUE NATURE OF FIRES INVOLVING COOKING MEDIA AND MODERN COOKING EQUIPMENT

Fires involving cooking media are unlike most other fires. In the United States a new classification of cooking media fires – Class K – has been recognized by the National Fire Protection Association (NFPA) Standard 10 and by Underwriters Laboratories, Inc. in the ANSI/ULI Standard 711. Both of these organizations realized that these fires are not like more traditional flammable liquid fires involving gasoline, lubricating oil, paint thinner or solvents. Let's take a look at what makes cooking oil, fat and grease fires so unique.

Cooking oils used for frying have a wide range of auto-ignition temperatures. Auto- ignition of the oil may occur anywhere from 550°F to 725°F (U/L test requires an auto-ignition at or above 685°F). In order for this auto-ignition to occur, the entire mass of oil, whether measured in ounces in a small pot or up to 120 lbs. in a deep fat fryer, must have been heated beyond the auto-ignition temperature. After auto ignition has occurred the oil will change its composition slightly while burning. Its new auto-ignition temperature may be as much as 50°F lower than it's original auto-ignition temperature. This fire will be self-sustaining unless the entire mass of oil is cooled below the new auto-ignition temperature.

SAPONIFICATION AND COOLING OF COOKING OIL FIRES

In the mid 1960's it was discovered that by applying sodium bicarbonate dry chemical or potassium bicarbonate dry chemical to burning cooking oil, a unique phenomenon called saponification would occur. All cooking oils, greases and fats have saturated fat in them. Another term for saturated fats is free fatty acids. By adding an alkaline extinguishing agent (such as sodium bicarbonate dry chemical) to the free fatty acid a type of soapy foam is formed on the surface of the oil. The generation of this foam is called saponification. It will act like a traditional fire fighting foam to secure the vapors, generating steam and extinguishing the fire. ABC or multi purpose dry chemical will not have this saponification effect because the base chemical (ammonium phosphate) is acidic in nature.

Pic courtesy of Amerex Inc.

Recent tests have shown that saponification using dry chemical is not sufficient to cool down the entire mass of a deep fat fryer. Dry Chemical extinguishers capable of extinguishing 300 square feet (17 feet x 17 feet) of heptane fires were incapable of extinguishing and securing the 2.25 square feet (1½ feet by 1½ feet) surface of a deep fat fryer even though sodium bicarbonate was being used. It was discovered that wet chemical agents using liquid solutions containing an alkaline mixture (typically potassium acetate, potassium citrate, potassium carbonate or combinations thereof) were far more effective in extinguishing these fires. The combination of a fine mist spray and the saponification characteristics of the agent secured the vapors and cooled the entire mass of oil below its new auto-ignition point.

New Classification Cooking Hazards

TESTING OF FIXED SYSTEMS PAVES THE WAY FOR A NEW CLASSIFICATION

This lead to the development of automatic systems using specially designed nozzles that are tested by ULI on actual deep fat fryer fires and proved more effective. These systems use an alkaline wet chemical solution delivered through a piping network to a fine spray mist nozzle specifically designed and tested for a particular appliance, plenum area or duct. The system will either discharge automatically through the use of fusible link thermal detectors or manually using a manual pull station.

These systems were specifically designed and tested under severe fire conditions and have proven to be extremely effective at extinguishing restaurant fires in the United States and other countries. ULI using the ANSI/ULI Standard 300 conducts rigid, consistent testing that simulates heavy grease loading, long "pre-burns", specific nozzle locations and extreme conditions to assure that the systems will perform properly. This Standard, adopted in 1994, uses actual commercial appliances in fire tests. Each type of appliance (such as a fryer, range, charbroiler, griddle and wok) has its own specific fire test. Specific amounts of agent, agent application rates and nozzle patterns are confirmed during and after successful extinguishment and securement of the test fires. Piping limitations are also determined through hundreds of piping network scenarios that are physically constructed for experimental tests. These tests verify that the amount of agent and the rate of application for each nozzle will always meet the requirements determined in the fire tests.

NEW SYSTEM DESIGNS LEAD TO NEW EXTINGUISHERS

The evolution of fixed systems led us to the vast improvement of wet chemical agents and the investigation of hand portable extinguisher's effectiveness on these same hazards. Underwriters Laboratories, in cooperation with NFPA and FEMA (Fire Equipment Manufacturers Association), conducted hundreds of tests comparing the effectiveness of Class B rated dry chemical extinguishers with newly developed wet chemical extinguishers. Prior to this series of tests, NFPA 10 required a 40B rated dry chemical fire extinguisher using either sodium bicarbonate based agent or potassium bicarbonate based agent for kitchen protection. It seemed logical to assume that if an extinguisher could achieve a 40B rating by consistently extinguishing a 100 square foot heptane fire, then a deep fat fryer with liquid surface measurements of less than three square feet would be well within that extinguishers capabilities. After reviewing the test results, Underwriters Laboratories concluded that kitchen grease fires were unique and that Class B fire ratings were not applicable.

The evolution of fixed systems led us to the vast improvement of wet chemical agents and the investigation of hand portable extinguisher's effectiveness on these same hazards.

NEW "K" CLASSIFICATION TEST STANDARD

Borrowing from their extensive research and testing experience with restaurant fire suppression systems under the ANSI/ULI Standard 300, Underwriter's Laboratory started to test extinguishers for a Class K listing for portables. The new test requires the use of a commercially available gas or propane fired deep fat fryer with a nominal 80 lb. shortening capacity. After being heated to auto ignition (which must occur above 685°F), the extinguisher is discharged on the fire in a fully open position. The U/L test requires the valve to be open until the extinguisher is empty at which time the heat source to the fryer is turned off. The fryer must not re-ignite for a period of at least 20 minutes or until the temperature of the shortening decreases to 60°F below its demonstrated auto-ignition temperature, which ever is longer (for more detailed information see ANSI/UL Standard 711 or NFPA 10 – 1998 Edition Section A-2-3.2).

The resulting new generation of kitchen wet chemical portable fire extinguisher has quickly proven its worth. Fire losses are lower. Down time and clean up after a fire are minimal. Training is easier; extinguishing is faster and safer.

ASTROflame

Passive fire protection products are used in fire protection systems to resist, retard and isolate a fire and the associated smoke and fumes: they do not in themselves extinguish a fire hence they are classed as 'passive protection'.

A key design requirement for fire protection products concerns public safety – the guarantee of a specific fire resistance/retardation time increases the time available for the evacuation of a building. Fire protection times vary between 30 minutes up to 6 hours, dependent on the particular product and application.

The flame retardant and smoke stopping capabilities of these products enable fire, rescue and emergency services to undertake their jobs in a more controlled environment. Finally damage to the building and contents resulting from a fire may be significantly reduced by the installation of passive fire protection products.

Astroflame are manufacturers of passive fire stop products, draught and weather sealing systems for the construction industry, the range covers Door Protection, Finger Protection, Lighting Protection, Fire Stop Products, Mastics & Foams, Draught Proofing, Acoustics and Disabled Access seals & Anti Graffiti Paint.

A comprehensive range of intumescent passive fire stopping products for use in walls, floors, ceilings, doors, ducts and other fire rated compartmentation structures.

Fire testing has been carried out by Warrington Fire Research, Chiltern Fire, BRE, Loss Prevention Council, LANTAC Building Control Approval and NHBC Type Approval amongst others.

Products are available ex-stock in over 50 countries world-wide, with overnight AM delivery as standard in the UK and fast despatch by road, sea or air for world-wide destinations.

With an in-house design and test facility offering a fast downtime on new product innovations from concept to completion, Astroflame will be pleased to discuss your construction product needs.

Intumescent fire protection products are covered within the site www.astroflame.com along with smoke rated threshold, perimeter and door bottom seals.

Draught proofing, Acoustic seals and Disabled access are covered in the site www.astrodraft.com.

The entire Astro group has undergone an extensive quality and reliability programme to ISO9001:2000 approved.

New products are added to the range all the time – to keep up to date bookmark the websites www.astroflame.com and www.astrodraft.com.

For further information, please contact:
Astroflame
Tel: +44 1329 844500
Website: www.astroflame.com

GE INFRASTRUCTURE COMPLETES ACQUISITION OF EDWARDS SYSTEMS TECHNOLOGY

Broadening GE's Security Business, Complementary Technologies and Channels to Market Will Create Significant New Growth Opportunities

GE Infrastructure, a unit of General Electric Company (NYSE: GE), announced today that it has completed its acquisition of Edwards Systems Technology (EST), the fire detection systems business of SPX Corporation (NYSE: SPW).

"GE Infrastructure is rapidly becoming the premier security provider and acquiring Edwards positions us as a leader in the $5 billion fire detection and life safety segment," said Bill Woodburn, President and CEO of GE Infrastructure. "By combining Edwards' technology and channel strength with the broader Security offering of GE, we can now offer an integrated facility management solution. We see significant revenue and cost synergies with this combination, and expect the acquisition to be accretive to GE's 2005 earnings."

According to Ken Boyda, President & CEO of GE Infrastructure's Security business, "We're seeing a convergence of technologies in the security arena, and a strong fire & life safety business is key to presenting an integrated facility management solution. Since fire detection systems are the only universally mandated security technology, there is significant opportunity for us to grow sales in complementary areas like access control, video surveillance and related services for commercial and large scale infrastructure projects."

The business will become a part of GE Infrastructure, Security's Engineered Systems business.

About GE Infrastructure

GE Infrastructure, headquartered in Wilton, Conn., is a high-technology platform, comprised of some of GE's fastest-growing businesses, including the Security and Water & Process Technologies platforms. These global businesses offer a set of infrastructure protection and productivity solutions to some of the most pressing issues that industries face. Learn more at www.geinfrastructure.com.

For more information about GE's Security business and our product offerings, please visit www.gesecurity.com

CRANFORD CONTROLS LTD

A privately owned company formed in 1997. We manufacture fire alarm sounders and accessories to the highest standard from our brand new purpose built 14,000 sq ft unit located in rural Hampshire.

The company has increased its turnover each year due to its core focus on Quality, Customer service and the Design and Manufacture of products to meet and exceed the expectations of our Customers.

Our Sales team pride themselves on an efficient and courteous service both to our UK Customers and to our growing number of overseas Customers. We are experienced in shipping goods to all corners of the world. Most of our products are available ex/stock and where possible we despatch orders within 48 hours across the globe.

Cranford Controls has always invested heavily in new product development. Because of this our range of sounders and other products have been designed to be at the cutting edge in terms of specification, reliability and quality. Most of our R&D is carried out in house and we have full CAD facilities. This gives us the advantage of being able to design and model new products quickly.

Our factory is approved to ISO9001:2000 and continued investment in production equipment and processes helps us to keep our costs competitive. All products are 100% tested before leaving the premises.

The range of products we provide include Sounders, Door Magnets, Beacons, Sounder Beacon Units, Power Supplies, Strobes, Motorised Bells, Voice Enhanced Sounders, Ancillary products, Intrinsically Safe Solutions, Flameproof Sounders/Beacons etc.

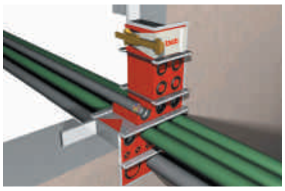
Heavy investment in approvals is being undertaken by the company to meet the modern demands of the global marketplace. We are already able to offer EN54 approved Sounders and Power Supplies from stock.

The Vantage VTG-32E sounder has full EN54-3 approval and comes as standard with 32 tones to suit every need. Our range of low-current Beacons and Sounder/Beacon combinations are the perfect compliment to the Vantage sounder.

If you would like further information on our products or services then please feel free to contact our friendly team.

Full contact details can be found on our website at www.cranfordcontrols.com

NEW TECHNOLOGY LEADER IN MULTI CABLE TRANSITS



Rectangular MCT with Quick-Fix TCM

Each electrical engineer who is concerned with design and installation knows about the Technology of Multi Cable Transits – as these systems replaced the conventional coating and mastic systems by and by. The advantages of MCTs are quite obvious: fast assembly, no drying time, high load capacity and in addition to the fire protection also smoke- and pressure-tightness. At fire tests, independent of standards applied, smoke is no assessment criterion since flue gas cannot be measured in an extensive fire test. Only because of this fact coating and mastic systems can pass a fire test and obtain an approval. On the other hand, MCTs are always tight and therefore they can be used for various applications. Wherever – beside the fire protection – also tightness against gas, water and dynamic pressure is required you'll find MCTs.

Some years ago, a blue modular system revolutionized the MCT Technology. Adaptable "peel off" Multi Diameter Modules conquered the world market and are used in many areas of cable installations today. The technicians of bst-firestop.com however improved this MDM Technology by the decisive factor "reduced manpower". bst-firestop.com offers the "Quick-Fix TCM Technology" (Tolerance Cable Modules) and has become global technology leader within shortest time. Adaptable "Multi Insert Modules" (MIM) enable the use of entire module rows and Quick Adapters (in different colours for an easy selection) with diameter tolerances of up to 5mm require only an approximate adjustment to the cable. This saves working time and provides an immediate safety. Quick Fix TCM has already made its way in many fields of application and technicians and workers worldwide trust in the TCM Technology supplied by bst-firestop.com.

Cable penetration installed with Quick-Fix TCM

Quick-Fix Tolerance Cable Module

Get more info on www.bst-firestop.com or visit us at INTERSCHUTZ 2005 in hall 13, stand no. C74

METRON ELEDYNE ANNOUNCE THE ARRIVAL OF THE NEW FD3E

After 35 years continued engineering excellence in fire pump design/control, **Metron Eledyne** is proud to announce the arrival of the new FD3e.

This new product builds on an already successful model incorporating independent battery chargers rather than one dual unit.

A more aesthetically pleasing design, offers new improved door layout, providing greater access to all components inside.

Additionally we are able to offer more standard options than ever before, making our controller more versatile and suitable to an increasing number of applications. An added bonus is the economical cost.

The 'feature rich' FD3e mark II is both FM approved and CE marked as well as conforming with the latest NFPA 20 and UL218 regulations.

This globally accepted controller, which has been installed worldwide, reflects our high standards and ensures we remain the number one installer and producer in Europe.

For further information, please contact:
Metron Eledyne
Tel: +44 (0) 1476 590600
Website: www.firepumpcontrols.co.uk

NEW WIDE RANGE FOAM PROPORTIONER FROM MATRE MASKIN AS

The new sprinkler proportioner from **Matre Maskin AS** were recently tested and certified by **VdS**, the leading German insurance inspectorate, in accordance with their latest rules. The proportioners with a range up to 9.000 lpm, were tested across this entire spectrum with proportioning ratios of 1% and 3%. According to the VdS requirements for accuracy, the tests gave optimal results. In addition, the proportioners were exposed to severe testing, such as the pressure test, water hammer test and overstrain test at a flow 150% above the maximum nominal capacity.

The factory set exact foam proportioning (1 or 3%) that eliminates the need for fine adjustment on site, resulting in labour cost reduction and foam concentrate savings.

This new generation of sprinkler proportioners enables regular testing of foam sprinkler systems as specified in the VdS CEA 4001 and NFPA-16 rules. The regular test procedure stated therein with a low flow and limited foam concentrate consumption is possible when the **Matre** proportioners are applied. Accuracy and reliability in foam proportioning, cost reduction through low foam concentrate consumption, low disposal cost of waste water and a positive effect on the environment are all results of using **Matre** sprinkler proportioners.

The new wide range proportioner is suitable for bladder tank systems as well as for foam pump pressurized systems.

The product is already installed in a lot of systems, both sprinkler systems and deluge systems where a wide water flow range is needed.

Companies with an interest in innovation and efficiency should go for the **Matre** proportioners approved by VdS.

For further information, please contact:
Matre Maskin AS
Tel: +47 53 42 77 44
Website: www.matre.no

PROMAT LAUNCH COMPREHENSIVE FIRE-STOPPING RANGE

PROMAT UK, the leading producer of high-performance fire protection materials has launched a premium range of fire-stopping materials.

Promaseal provides designers, specifiers, contractors and building occupiers with a comprehensive, cost-effective solution to modern fire-stopping requirements. Effective penetration sealing prevents the passage of smoke, toxic gases and fire through gaps around services in walls, partitions and floors.

The new Promaseal system runs from basic gap sealing, to protecting cables and pipes through walls and floors, shielding regularly altered building services and creating active movement joints.

Products in the Promaseal line-up include:

- **Promaseal Sealant:** a water-based acrylic intumescent sealant for sealing small gaps and holes, offering up to four hours fire resistance.
- **Promaseal Silicone Sealant:** providing up to four hours fire resistance for concrete or masonry substrates and one hour for timber.
- **Promaseal Fire Barrier:** slabs of high-density mineral wool with a white endothermic, ablative coating, providing more than four hours fire resistance.
- **Promaseal Fire Compound:** dry powder mixed with water to provide up to four hours floor and wall penetration seals.
- **Promaseal Expansion joint strip:** compressive, flexible seals consisting of layers of intumescent material bonded to Class 0 foam. It is tested for up to four hours in joints within walls and floors.
- **Promaseal UniCollar:** a boxed continuous strip cut to length on site, which means there is no need to buy individual collar sizes. It is tested for up to two hours in walls and four hours in floors.
- **Promaseal Pipe Wrap:** a water-resistant sleeve around a flexible, intumescent core.
- **Promaseal Fire Pillows:** fire rated fibre-glass fabric bags filled with a fire resistant granular fill, offering up to three hours fire protection.

Promat UK recently launched a ground-breaking design and installation guide: The Passive Fire Protection Handbook is a one-stop shop for all the information that professionals need to ensure they meet the rigorous demands of modern fire protection. The launch of the new Promat website also complements this piece of literature and can be viewed via www.promat.co.uk.

For further information, please contact:
Promat
Tel: 01344 381400
Website: www.promat.co.uk

NEW PRODUCT ANNOUNCEMENTS

The **N-252** is an extended coverage pendent and recessed pendent sprinkler for density/area design with a K Factor of 25.2. It is approved for coverage up to 196 square feet (14′ x 14′) for extra hazard and storage applications. The N-252 is approved as a density/area sprinkler with minimum end head pressure of 7 psi. It can be installed directly on the piping for exposed pipe systems. Because it is a pendent, sprig-ups are not required for larger diameter piping. Installations for finished ceilings utilize the push-on, thread off FP recessed escutcheon which provides a ½″ (13mm) adjustment. The N-252 is cULus Listed for a minimum of deflector to commodity distance of 36″ and for unobstructed or non-combustible obstructed construction. This sprinkler complies with the criteria for protection of retail stores as described in NFPA 2002, section 12-7.2.

The **J-168** is a new control mode, density/area upright sprinkler with a K Factor of 16.8. This sprinkler is primarily for extra hazard and storage occupancies as designed and installed under NFPA 13 requirements. K-16.8 sprinklers can allow reduced design areas, higher storage, reduced ceiling clearance to storage, and other savings in sprinkler design from smaller K Factor sprinklers. The J-168 uses the robust Model G solder capsule that has been installed in millions of sprinklers over the last 30 years. This cULus Listed sprinkler is available with various temperature ratings and finishes.

Multipurpose Riser – Finally, a riser designed especially for providing an alarm on combination sprinkler and plumbing systems for single-family residential systems. This unique design provides an alarm only when water flow in the system is in the 11 to 13 gpm range. This is the range of a typical single fire sprinkler flow. Typical domestic water flow demand should not exceed this preset range for an alarm condition. The stainless steel riser is cULus Listed and also NSF approved for potable water use.

For further information, please contact:
Reliable Sprinkler
Tel: +44 (1372) 728899
Website: www.reliablesprinkler.com

SMOKE ASPIRATION TECHNOLOGY FROM SECURITON SWITZERLAND

Based in Switzerland, **Securiton** has been dedicated to the electronic fire detection since 1948. Securiton develops and manufactures a large range of different fire detection systems to fulfill broad customers' needs from tunnels, commercial buildings, industries, telecommunication, utility stations and others.

ASD Aspiration Smoke Detection System from Securiton is an effective, yet flexible solution for customers who demand early fire detection. Whether in room monitoring or in object monitoring, one ASD Aspiration Smoke Detector can run up to 100m of pipe with up to 20 suction holes. Highly sensitive detectors enable earliest fire detection. The system is VdS approved.

Unique features of ASD 516:

1. Double detectors per system, ensure accurate detection results and best safety redundancy. This feature is useful especially when the ASD system is linked to automatically released extinguishing systems.
2. A smoke level indicator indicates the smoke concentration and freely programmable outputs are available for triggering 3 pre-alarm signals accordingly. These pre-alarm outputs can be used to activate data backup process to prevent loss of valuable information on servers, or can activate other pre-alarm sequences.
3. Integration into SecuriPro Fire System with fully remote access to all functions of the ASD. Up to 24 x 75 ASD`s can be integrated into a SecuriLine network with fully redundant loop configurations
4. Up to 6 remote detectors can be added to one ASD system. Installation of up to 6 detectors inside pipe network enables individual recognition of zones or objects. The remote detectors can be mounted directly on the equipment to ensure the shortest smoke traveling distance, and give individual identification for each monitored item.

For additional information visit www.securiton.ch, or send an e-mail to export@securiton.ch

THEY LEARNED FIRE PREVENTION AT WPI

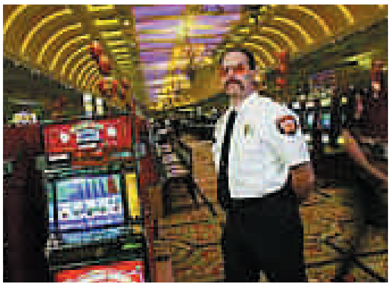
Graduates of WPI's Fire Protection Engineering program now total more than 350 and, worldwide, contribute in a variety of ways to the broad field of fire prevention and fire safety. They educate and train fire safety professionals, provide technical assistance for firefighters, review new construction projects and building design plans, work with developers to assure building and fire code compliance, investigate fires, and analyze fire research.

The work of FPE graduates is evident in every aspect of our daily lives – at home, at school, in the workplace, in entertainment venues and other public places, and in all forms of transportation. Whatever the field of expertise, each has a single goal in mind: to save thousands of lives each year by making the world a safer place in which to live.

Paul Donga, *Fire protection supervisor, Boston Fire Department's Fire Prevention Division's Plan Review and Acceptance Testing Unit*

Paul Donga discovered WPI's Fire Protection Engineering program while working for Boston's Building Department. "I wanted to get into the fire code compliance reviews area," he says, "but my background was in electrical engineering." He landed a fire related job and then entered the FPE program. "I got exactly what I went for at WPI: tools for analysis," he says, which he uses daily reviewing building plans and overseeing acceptance testing—the final hurdle building owners must jump before occupying their structures.

Kenneth Miller, *Assistant fire protection engineer, Las Vegas Fire Department*



Ken Miller is satisfied with the progress he's helped facilitate in Las Vegas. "In my seven and a half years, there have been documented cases where buildings I've approved have spared many lives and in which the fire sprinkler systems have helped extinguish dozens of fires," he says. "To minimize life loss and property loss– that's the way to do the best you can with your knowledge."

David Sheppard, *Senior fire research engineer, Fire Research Laboratory, Bureau of Alcohol Tobacco Firearms and Explosives (ATF), Ammendale, Md.*

Dave Sheppard has one word to sum up his job: fun. He works in a huge laboratory—half of a 176,000-square-foot facility—where materials and fluids are regularly set afire so scientists can study their fire- and smoke-related properties. The place is big enough to fit cars, buses, and even reconstructed buildings for studies. In the other half of the lab, scientists conduct traditional forensics work, such as analyzing blood traces, fingerprints, and bullets. Sheppard wears three hats at ATF: scientific supporter for arson investigations, trainer, and fire researcher.

(Excerpted from an article by Eileen McCluskey)

For further information, please contact:
WPI
Website: www.wpi.edu/+ADLN/FIRE

CONCORDE EXHIBITIONS OFF TO A FLYING START

With optimum fire and security protection from Vision Systems

Vision Systems is providing complete protection for Concorde aircraft exhibitions, with VESDA and ADPRO selected as the best products available to meet stringent fire and security requirements for these priceless assets.

Vision Systems' VESDA Aspirating Smoke Detection is fully protecting the decommissioned Concorde aircraft at the Museum of Flight in East Fortune, while ADPRO, Vision Systems' remote CCTV surveillance system, is shielding the Concorde aircraft now on display at Manchester Airport's Aviation Viewing Park.

For the Museum of Flight, VESDA offered the only suitable solution for safeguarding the 'Alpha Alpha' Concorde, which arrived from Heathrow Airport after a very complex transportation process. The Museum faced the challenge of needing to install highly reliable fire protection without compromising the aircraft's distinctive appearance. The aircraft is already on public display and is due to take part in a major exhibition on the story of Concorde, opening in March.

Says David Dunn, Electronics Systems Officer, at the Museum: "As with any museum object, the aim was to leave the aircraft in its original condition as much as possible, so the last thing we wanted was to install large, conspicuous sensors. VESDA offered us the complete discretion we needed and it also provided us with the assurance of the earliest possible warning of a potential fire and excellent reliability. These are important considerations with an asset such as Concorde."

Manchester Airport's Aviation Viewing Park also needed to find a reliable and unobtrusive security system for its Concorde 'Alpha Charlie', which now resides on its own runway within the centre. The organisation needed to ensure that there was reliable protection and detection around the perimeter of the exhibit, whilst providing a 24-hour monitored system. The ADPRO product was selected for its ability to provide a reliable remotely monitored solution with images of the highest quality.

ADPRO, a renowned leader in providing reliable and highly effective protection of assets, met this need perfectly. ADPRO delivers fast and high-quality images, accurate alarm verification and round-the-clock monitoring from a single central location. Only ADPRO's portfolio of automatic intrusion detection, remote site management and video surveillance technologies could be relied upon to protect such a high-profile site as Manchester Airport's Concorde exhibition.

As a provider of both aspirating smoke detection and digital CCTV security and surveillance solutions, Vision Systems is a pioneer of integrated superior protection. Vision Systems safeguards numerous sites and different types of industries worldwide – from high-profile exhibitions and irreplaceable data to telecommunications facilities and financial institutions.

Vision Systems will be exhibiting its award-winning range of ADPRO video security products at IFSEC stand no: K95 and the VESDA smoke detection system and Millbank Voice Alarm solution at FIREX running in the adjacent hall stand no: L20.

For further information, please contact:
Vision Systems
Tel: +44 (1442) 242 330
Website: www.millbank.co.uk

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INTRODUCING 3M™ RF-Series Fire Fighting Foam Concentrates

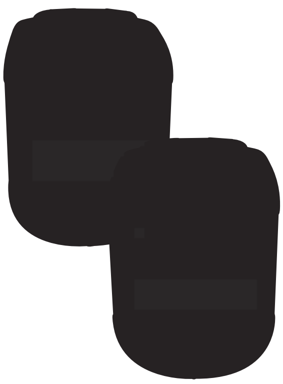
The first sustainable alternative to AFFFs and fluoroprotein foams

Concerns about the long-term environmental effects of fluorochemicals have created a growing demand for alternative fire protection solutions that are both effective and sustainable.

Now, after years of res [redacted] flammable liquid fire fi [redacted] give you AFFF-quality [redacted] free formulation!

3M RF-series foams a [redacted] to meet or exceed the [redacted] performance standard [redacted] ICAO level B and CEN [redacted] providing fast extingui [redacted] effective vapour suppr [redacted] and excellent burn-ba [redacted] And they can be used [redacted] conventional fixed and [redacted] application devices an [redacted]

Learn how 3M RF-seri [redacted] help you win the battle [redacted] environment – withou [redacted] compromising the saf [redacted] the people and proper [redacted] under your care. For m [redacted] information, and a cop [redacted] our free brochure, con [redacted]



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Issue 23 – August 2005

IFP

INTERNATIONAL FIRE PROTECTION

IFP ON-LINE www.ifpmag.com

The Global Voice for Passive & Active Fire Protection Systems

The world's a big place to protect. Good thing we're here.

Think of a location that needs to be defended against fire. Chances are products from the Fire Suppression Group of Tyco Fire & Security are on the job. How is that possible? By maintaining a presence on every continent of the globe. And with the world's leading fire suppression brands, including ANSUL®, MACRON™, NIEDNER® and TOTAL™, it's no wonder we're our customers' most complete source of answers.

Tyco Fire Suppression Group. The fire protection people always right where you need them to be. Near.

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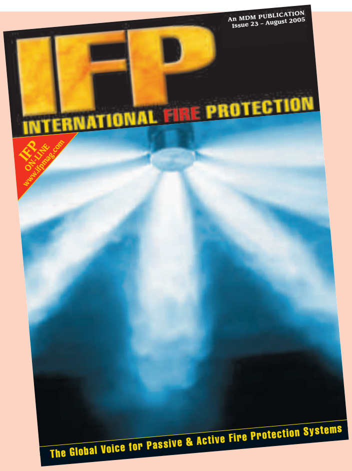

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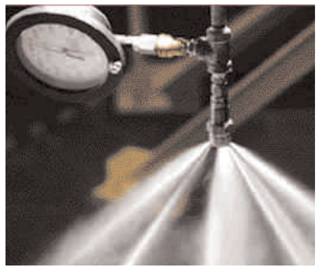

YOU STILL HAVE A BUSINESS!

Are you aware that under new fire legislation all employers will have to do a fire risk assessment to ensure business continuity and contain the spread of fire and smoke.

The ultimate penalty for making the wrong decision could be a prison sentence.

To secure business continuity firewalls are seen as one of the most cost effective means of improving passive fire protection in new and existing buildings.

- Performa System is the best way to specify firewalls with a guarantee of performance.
- Performa System will protect your building and your people's jobs.
- One-stop design, advice and installation service.

Protect your future – use Performa firesafe, non-combustible composite panels

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Airport fire protection

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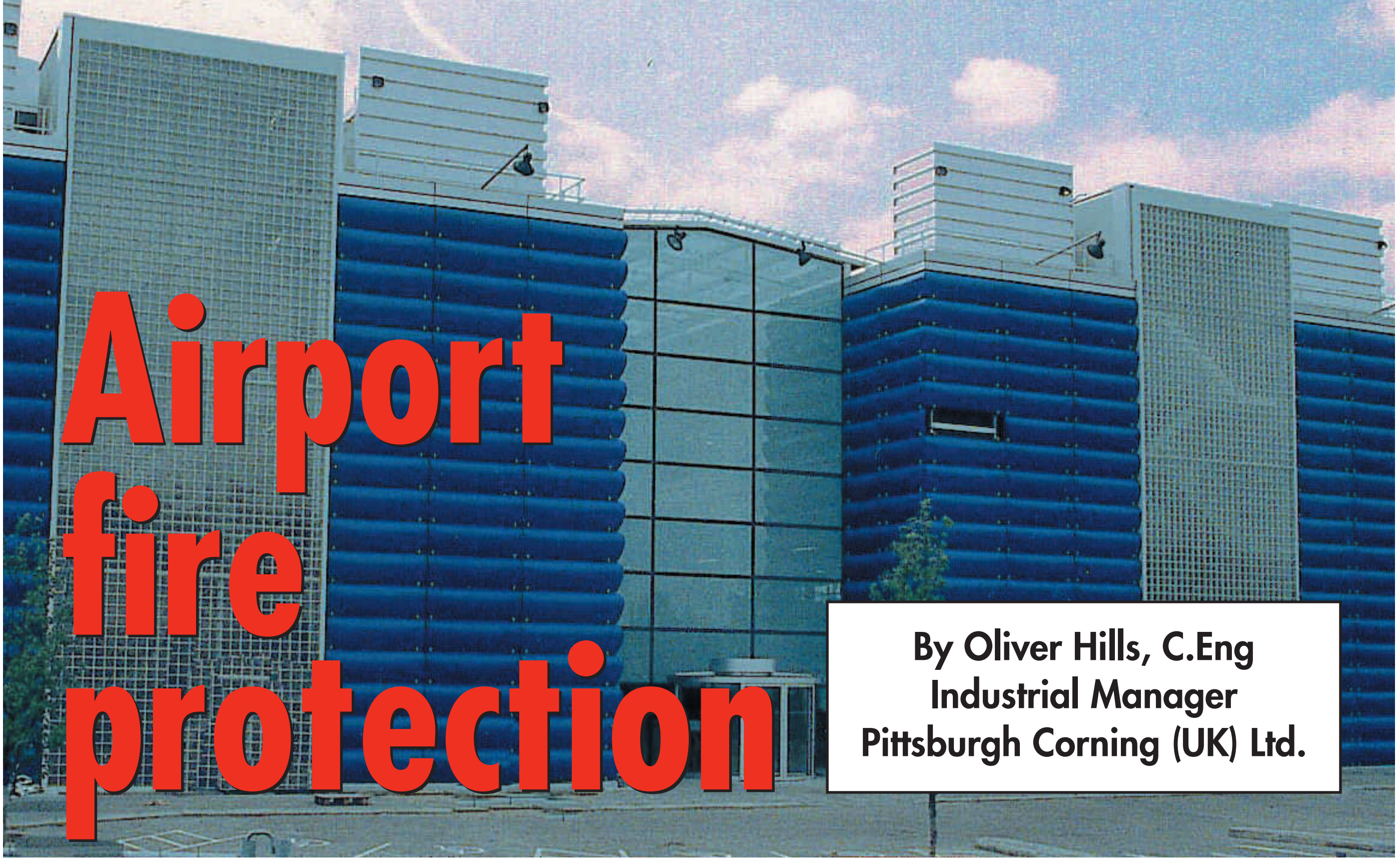


Heathrow airport

DO THEY NEVER LEARN? Recently, while waiting for yet another delayed flight, I glanced up at the ceiling of a refurbished section of my local international airport and noticed newly-installed plastic-foam cold-piping insulation. It was a brand most likely falling into Euroclass C or D, except that the particular manufacturer doesn't like to talk about Euroclasses.

Why does this matter? An examination of the toxic smoke produced by some insulation materials (like the one installed at my local airport) at just 400ºC produces some sobering results (below right, tests by Elektro-Physik Aachen gmbh).

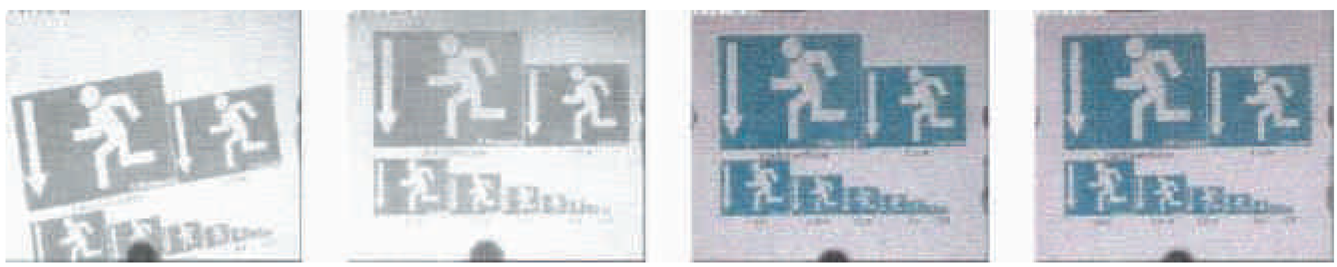
The contrast with cellular glass (highest rated Euroclass A1), the only truly fire-safe cellular insulation material, is dramatic: if cellular glass is caught in a fire it will neither contribute to the fire nor create toxic smoke (below).

The plastic foam manufacturer could claim that his product was fire-safe to BS476 class 0 but the Federation of Master Builders rightly states* *". . . there is absolutely no connection between Class 0 products as we currently know them and the incoming Euroclass A to F system".*

The airport industry worldwide suffers about one serious airport fire each month, according to British Airport Authority's group fire strategy manager Russell Timpson, yet there seems to be a reluctance by some parties to take into account the lessons learned from previous major fires and to look at similar potential hazard sources in other areas of airport construction. The BAA appears to take fire prevention seriously at a high level, particularly on prestigious projects such as Heathrow Terminal 5, but the choice of insulation materials for other projects appears to be made in a less consistent manner by other local decision makers.

There has been a recent round of testing by the DETR comparing results from different test methods for wall and ceiling insulation. One plastic foam

(left) At the beginning of the test, (centre) after 15 minutes, (right) after 30 minutes. Smoke from Polyisocyanurate foam at 400°C quickly obscures escape signs in under 15 minutes



(left) At the beginning of the test, (second left) after 15 minutes, (second right) after 30 minutes, (right) after 60 minutes. Signs remain visible indefinitely when cellular glass is heated to 400°C, ensuring that escape is still possible

Chilled water piping with cellular glass insulation: no need for vapour retarder

manufacturer has reported on the Euroclass testing that, compared with the existing British Standard tests, *"For the product group as a whole [cellular plastics], no correlation was obtained between the Euroclass system and the UK system".* Rather than being a positive situation for the cellular plastic industry this is a serious concern. It has long been accepted that cellular plastic foams can be put in a similar category to wood (Euroclass D***) as being "self extinguishing"; would you want to be trapped in a burning wooden airport terminal? If the new Euroclass test results infer that the risks of using plastic foam insulation in airports may be significantly more serious than previously thought then this is a potentially serious issue.

Some major airports, notably Frankfurt, Düsseldorf and Heathrow (Terminal 5), have recognised the need for genuinely non-combustible, non-smoke producing insulation materials, often through bitter experience of the fatalities which can result from potentially-dangerous alternatives. Others may have recognised the danger but tried to limit it by the use of intumescent coatings over plastic foams or by using fibrous insulation materials.

These approaches present several troublesome scenarios. Airports are busy, hot environments with great need of effective air-conditioning systems. Much piping in airports will be for chilled water systems or for chilled ducts, which risk experiencing severe condensation if the vapour retarders fail. They are insulated to both prevent condensation and, as our energy costs continue to escalate, to limit heat gain. Using mineral fibre on such installations is extremely short-sighted: the slightest contact with air (via pin holes or tears in vapour retarders) will cause water vapour to condense inside the insulation and then wick throughout the system very rapidly. In the frenetic airport environment damage to vapour retarders is a fact of life. Wet mineral fibre might not burn but will promote corrosion under insulation and greatly increase cooling-plant running costs. It has been shown that just 4% moisture can reduce thermal efficiency by a staggering 70%. The financial consequences can be dramatic but are often ignored in capital budgets to be suffered year on year in operational budgets.

Water pipes for fire-fighting systems can also experience the same problems. They need to be insulated to avoid ice formation in Winter but inappropriate insulation materials create the ideal hidden conditions for corrosion under insulation with consequences of pinholing and loss of water pressure.

Airports also have piping and tanks for fuel oils: there have been instances where minor leaks of fluids have wicked along, and saturated, mineral fibre insulation and been the cause of fires, even spontaneously igniting fires for some hot applications. Surely it would be indefensible to install such "fuses" in a public building.

In reality some specifiers either ignore the unsuitability of mineral fibres for chilled water piping or recognise the problem and choose to use cellular organic plastic foams, ignoring fire/smoke risks. These can produce significant quantities of smoke in a fire: more often it is this toxic smoke which has been the cause of fatalities.

Equally bizarre is where chilled-water fire-wall penetrations use different insulation materials from those used for the main piping: there is no need! Cellular glass could be used to make a continuous insulation system through fire walls easily giving R120 minute fire protection. Discontinuities in insulation systems are a recipe for moisture ingress and premature failure

These problems are not only confined to airports, but also occur in hospitals, schools, road and metro tunnels. They are also not just confined to piping but also to walls, ceilings, roofs and partitions.

What is so regrettable is that there is no need to use inappropriate insulation materials in any of these applications. Cellular glass has been used successfully for decades to insulate both cold and hot pipework, as well as all parts of the building envelope and is completely inorganic. It cannot burn and so will not contribute to the spread of fire or to the production of toxic smoke. Moreover, being uniquely 100% closed cell, it does not rely on fragile vapour retarders to prevent condensation failures when

Corrosion under wet mineral fibre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CHANGED...
CHALLENGES
HAVE
CHANGED...
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At Tyco Fire & Building Products, innovations such as the ESFR-1, K17 Storage Sprinklers, ESFR-17, ESFR-25 and EC-25 are just a few examples of our commitment to meet the dynamic challenges of the 21st century.
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Deutscher Dom, Berlin: fire supported by mineral fibre

used on chilled water lines or cold ducts.

The oil and gas industry's unforgiving and risky environment demonstrates this perfectly. If you have a liquefied natural gas pipe you can protect it for hours against a hydrocarbon fire by using cellular glass insulation. If you try to do the same using a plastic foam such as polyisocyanurate the foam will rapidly melt, produce toxic smoke and contribute to the fire within minutes.

Much has been written about the tragic fire at Düsseldorf airport where 17 people died and up to 80 were seriously injured in 1996. It took nearly 4 hours to take back control of the fire and involved 701 personnel from 12 different rescue services.

Why did it happen? The cause was simply a combination of inappropriate insulation materials, poor smoke containment and human error.

Could it happen again? Yes: there are inappropriate insulation materials in public buildings already; even worse they are still being installed. Düsseldorf airport has taken its fire risks very seriously and put into place a very positive passive fire-protection strategy in their choice of thermal insulation materials, as have Frankfurt, Paris, Heathrow and many other airports.

Düsseldorf airport alone installed 11,000m^2 of cellular glass roof terraces, floor slabs, underground walls as well as insulating its ventilation ducts and chilled water piping with cellular glass. Frankfurt airport terminal 2 installed over 40km of cellular glass insulated pipes upz to 622mm diameter, 120,000m^2 of cellular glass on air ducts. These airports take the safety of their customers, the flying public, very seriously but they also have an eye to their own pocket. An insulation choice must be economic: these cellular glass installations will last for decades without premature failure due to water ingress and without risk of becoming a smoke or fire hazard.

Roofs and other parts of the building envelope often use inappropriate insulation materials, oblivious to the risks of thermal bridging: a typical roof structure can be perforated by many tens of thousands of metal fasteners creating both heat loss and great vulnerability to water ingress. Who would sit under an umbrella perforated with as many holes as a Swiss cheese? The same structure can be made economically from cellular glass without a single perforation. In addition the fire risks are immensely reduced. A localised fire under cellular glass will remain just that: very localised. Under a plastic foam it can spread with dramatic results.

Cellular glass installation at Roissy Charles de Gaulle Airport, France

However, we should not fall into the trap of thinking that it is only plastic foams which can be a fire risk: the Deutscher Dom in Berlin caught fire during works with mineral fibre insulation. Mineral fibres allow the passage of air: due to a wick/chimney effect beneath the copper cladding the fire propagated rapidly via the resin binders in the fibre and a ventilated space beneath the timber substrate.

Refurbishment after the incident was with cellular glass to avoid any future risk of using a wicking insulation material.

Those of us who regularly travel by aeroplane are often told that the most dangerous point in our journey is take-off or landing. I am not so sure about that. The airport terminal building can be a dangerous place: it feels like a virtual prison. The number of exit routes is severely limited to avoid the public spilling out onto the apron/runways, we face increasingly long and crowded waits in the lounges and it is the airport operator's desire to maximise the time that we are stuck in the internal "duty free" shopping centres and so maximise their share of our holiday spending money! Every effort needs to be made to ensure that these areas contain nothing which can contribute to the risk of smoke and fire.

While we contribute to global warming by our frequent low-cost flights we ought to have an additional thought about the energy use of airports and encourage the designers and decision makers to make better choices of insulation materials and select those which will remain as effective and as safe in 20 years time as the day they were installed. There is only one way to achieve this: by increasingly fitting cellular glass insulation to piping, ducts, walls, roofs and partitions and making the conscious decision to avoid using inappropriate insulation materials.

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***http://www.fireretard.com/building.html

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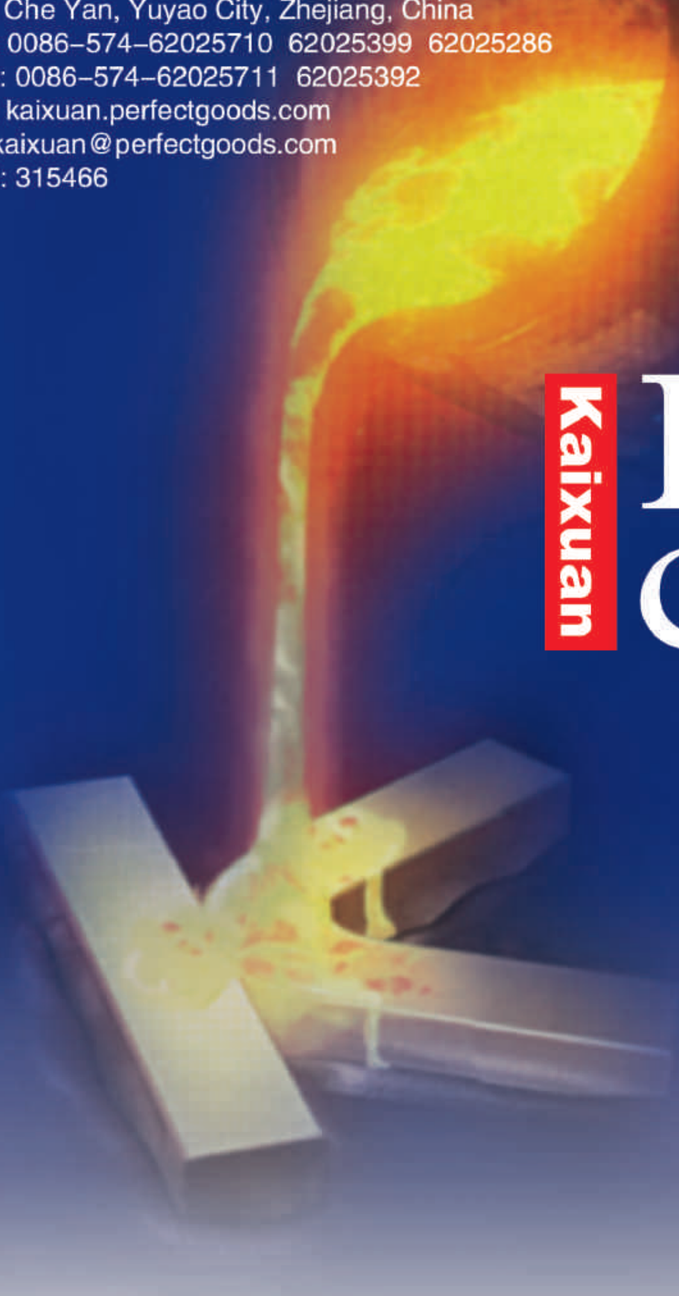


Kaixuan Fire control

The Sights and Sounds of Safety

Pic courtesy of Klaxon Signals

Kristian Johnson, Marketing Manager at Klaxon Signals, discusses the developments made in alarm warning systems and the impact of new legislation.

IN LIGHT OF THE DDA and EN54 directive, never before has it been more necessary to ensure safety and warning systems are up to standard. Perhaps of greater importance is making certain that the right system is specified for the right application, but the choice and versatility of alarm warning systems available in today's market make this no easy task.

From 32 tone interior sounders to wide area disaster signals, revolutionary directional sounders to state of the art desktop evacuation software; there is certainly no question that a system for everyone is out there, though the question of what and where is not so clear.

EVOLUTION

In the UK, the vast majority of alarms rely on rudimentary warning systems, often using only simple bells or electronic sounders. Many of these basic products have now been developed into more sophisticated units offering superior audibility and a wider range of tones. Due to consumer demand, modern sounders have been designed to overcome the problems of high current consumption that were often found with early electronic sounders. They now draw less than a tenth of the power of their predecessors and many sounders are available with very low consumption, in the 3mA to 5mA range for outputs of around 100dB(A).

Products for both indoor and outdoor use are now widely available with relatively high sound output and a wide choice of voltages, often incorporating up to 32 tones. Where a unit is required to perform in both indoor and outdoor applications, appropriate weatherproofing is fitted. It is also possible for this type of multi-purpose product to be fitted with a beacon, should the need arise.

The introduction of multi-tone sounders as well as voice sounders has come some way towards addressing the need for alarms that are situation and even country-specific, whereby a tailored message can be omitted in place of a standard alarm tone. Many countries have their own specific, well recognised alarm sounds and emergency evacuation signals, although this isn't the case in the UK. Products aimed at international markets need to, and more often than not do accommodate these differences to meet the localised needs of many countries.

Syrex 5 XN and Syrex 5

Beacons

Where voice-enhanced sounders are specified, they can provide the user with a clear and precise safety warning. User recordable sounders customise messages as well as allowing users to record multiple separate messages. These sounders are designed for use within the fire and industrial sector to enhance safety and security.

Many sounders are available on the market, including those designed principally as ceiling mounted units for use in fire alarm systems in areas with low ambient background noise. Intended to be installed under proprietary heat and smoke detectors, a sounder and detector can be located at one point, saving time and materials. Low current fire alarm sounders are ideally suited for long cable runs where a low current draw is required.

Powerful disaster warning sounders have been specifically designed to provide fire alarm warning outdoors, particularly where a high ambient background noise is apparent. These units can have an output of around 140dB @ 1m making them ideal for the large industrial sites where they are often situated. Rugged by design, outdoor wide-area use sounders offer higher audibility to enable the sound to carry over large distances and they can offer the facility of voice/PA capability.

SEEING THE LIGHT

To meet the demands of the market many sounders have been further developed to take their capability beyond that of a basic audible warning device. Such products are now available in the form of combined multi-tone audible/visual units. Sounder-beacon combination units are a necessity in many applications. In a smoke filled area a guiding emergency light on its own is insufficient, and in high noise environments a sounder may not be heard. The majority of security systems rely solely on audible sounders, but often the ideal solution should be a system that acknowledges the need for and incorporates sounder-beacon combination units.

Regardless of the type of sounder used the unit must be installed correctly to ensure maximum sound and light exposure. As sounders are designed to project a multi-directional sound, the centre of a room or wall is the most appropriate position for installation, though this may vary in areas with high noise hotspots. To check that the sounder can overcome any existing noise, background audibility should always be assessed before commencing installation. Sounders incorporating beacons must be visible to the eye; in contrast there are no real height issues with audible sounders. Naturally, the unit must be weatherproof if the sounder is to be installed outside.

High current consumption has been an issue long associated with beacon use, with xenon beacons often drawing excessive currents and most taking large current surges after each flash. This effect is often compounded when many units are used together: the cumulative effect can cause overloads in power supplies and sometimes disrupt other parts of the system.

It has been very important to find an alternative way to accommodate visual signalling. In security and fire installations, for example, low current consumption, reliability and synchronised beacon flashing is paramount.

Now beacons are available which use light emitting diodes as an alternative. LED beacons can produce light outputs similar to that of their xenon equivalents for currents of around 3mA. This allows the user to integrate these units with sounders, lowering installation costs and finally making loop-powered sounder beacons a real option.

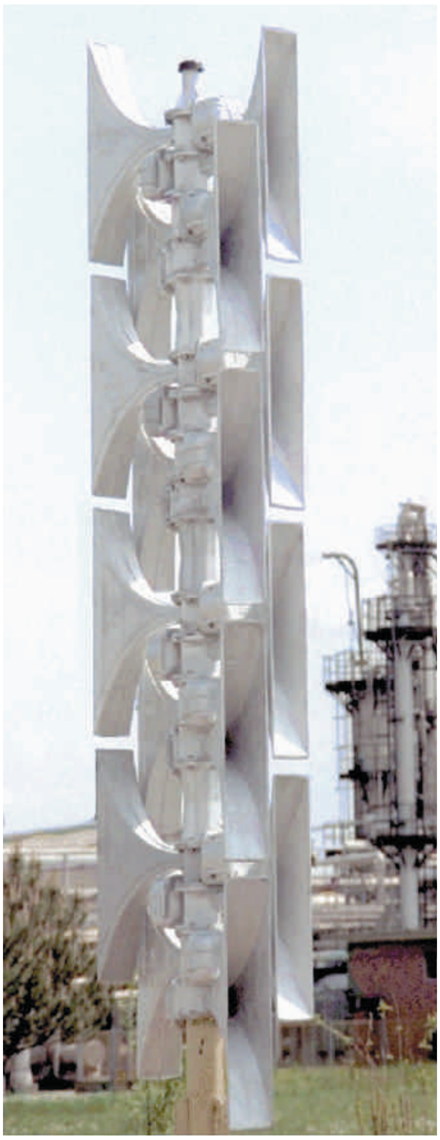
TECHNOLOGICAL INNOVATION

Directional sounder technology is a further extension which makes use of sound for evacuation rather than an alarm. New types of fire alarm sounders which use directional sounder technology to guide the occupants of a building to the emergency exits are helping to make escape easier. The new technology allows

Sonos composite red base

EZ-Exit

those with impaired vision, or any occupants of a smoke-filled building, to make a safer and quicker exit in the event of an emergency. As fatalities in fires are often caused by inhalation of smoke's poisonous gases, these sounders help to save lives by minimising evacuation time.



ES Siren 2

Conventional fire alarm sounders, using narrow sound frequencies which the brain cannot localise, merely alert listeners to the presence of danger, giving no information concerning the distance from or the location of the nearest emergency exits, and therefore relying on occupants' ability to exit using signs only.

In order for exit sounders to be located by the brain, the frequency content of the sound has to be as wide as possible (20-20,000 Hz). Sounders using directional sounder technology emit a broadband, multi-frequency sound, commonly referred to as white noise, whose direction can be easily detected by the brain. Intuitively understood, a rising or falling tone indicates whether to descend or ascend any stairs.

Used in conjunction with modern analogue addressable fire detection systems which can determine the source of a fire, a preferred evacuation route can be set by triggering the appropriate directional sounders.

Emergency warning computer software is a further step beyond the realms of the traditional security system. Such software can enable orderly evacuations by transmitting tailored instructions and exit maps in front of each PC user exactly when they are needed; overriding whatever is displayed on the screen. The systems are designed to complement audible warning systems and can be configured to warn of fire, security and other hazards. They can also be used to call individuals to help, such as fire or evacuation wardens.

If fire breaks out and a building's occupants need to evacuate, such systems can display maps, assembly points, sounds and animations to aid a swift and orderly exit. The programs can also be customised to display other messages for any need, such as those to alert First Aid personnel to an incident within the building, or to summon security staff discreetly.

LEGISLATION

Legislation plays a key part in keeping sounders and safety systems up to date. For example the Construction Products Directive (CPD) requires that all fire system sounders, point head detectors and point smoke detectors sold in Europe after June 2005 will have to comply with the relevant part of EN54 (ie parts 3, 5 or 7). Other fire detection system products sold in Europe will also need to comply with the relevant part on EN54 (rather than the national standards) at a future date. The impact on businesses in terms of time and costs required for product testing, approvals and amendments is as yet unknown, but the impact is certainly expected to be significant.

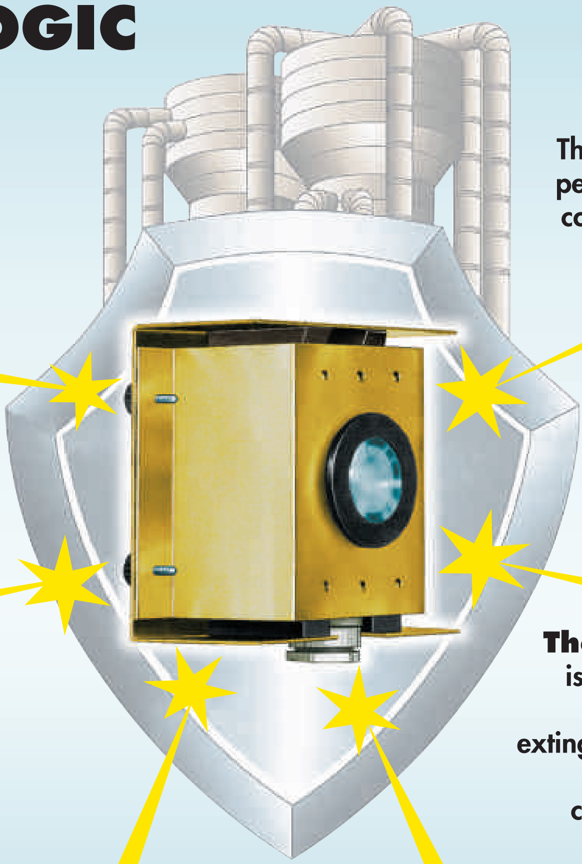
Organisations can begin to take preparatory steps to ensure they are acknowledging and indeed embracing the advice in the CPD. Where fire and security systems are concerned, the directive implies that fire equipment should be approved and tested by a certified body to show compliance to the CPD. The directive urges businesses to start making the necessary preparations within their product planning, to ensure that all product developments fall in line with the stated guidelines.

The Disability Discrimination Act (DDA), which came in to force in the UK in October 2004, will have a massive impact on all businesses regardless of trade or industry. It requires modification, or in some cases a complete overhaul, of many premises in order for them to be compliant with the act, with fire systems falling within the guidelines. Products incorporating sounder-beacon and/or directional sounder technology already acknowledge the need for security systems that cater for all, regardless of disability, by offering both audible and visual warning. Visual warning systems also adhere to the DDA's guidelines by offering guidance to the hearing impaired.

Klaxon Signals is working alongside its partner companies and customers to ensure its products and the installation of its products are in line with EN54, BS5839 and DDA. Any organisation or individual wishing to discuss its, or Klaxon's, obligations under the new legislation may contact Klaxon directly.

CONTROL LOGIC Spark detector

designed for dust collection systems to protect storage silos from the risk of fire.



Sparks fly at high speed.

They travel at a hundred kilometres per hour along the ducts of the dust collection system and reach the silo in less than three seconds

The CONTROL LOGIC SPARK DETECTOR is faster than the sparks themselves. It detects them with its highly sensitive infrared sensor, intercepts and extinguishes them in a flash. It needs no periodic inspection.

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ISO 9001

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**IR FLAME DETECTOR
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One detector can monitor a vast area and responds immediately to the fire, yet of small size.

Also for
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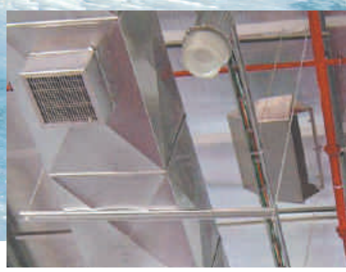
- **Industry**
  Sprinkler systems; Foam spray deluge systems; Medium/high expansion foam systems

Systems for aircraft hangars

Systems for high risk sites



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tyco Fire & Security

New Lastfire Foam Test

By Mike Willson of Angus Fire, based on his interpretation of the extensive testing that has been carried out to date using the LASTFIRE Protocol

Picture courtesy of Resource Protection International

Selecting the Right Foam for Storage Tank Fire Fighting

LARGE-SCALE HYDROCARBON STORAGE TANK fires are unique. They are large, deep-seated, and hot. Quite simply, they are among the most difficult flammable liquid fires to extinguish.

Today the pressure is on tank operators to demonstrate that they have taken all reasonable measures to extinguish such fires. A prolonged storage tank fire can threaten lives and the environment, incur massive financial losses, and lead to disastrous public relations. The latest research indicates that, while they are not as common as other types of fire, they are occurring ever more frequently. Adopting a "let it burn" policy is no longer an option!

Many factors need to be taken into account when planning storage tank fire protection. These include the use of fixed foam systems, the deployment of mobile monitors, and water/foam supply logistics. Another crucial factor, which is addressed in this article, is the selection of foam concentrate.

DEVELOPED BY OIL COMPANIES

There is a bewildering array of foam concentrates to choose from on the market, mostly described by unintelligible acronyms like FP, FFFP, and AR-AFFF. The challenge facing tank operators is to identify which of these different types of foam is the best for bulk storage tank fire fighting.

Meeting that challenge has recently been made much easier by the introduction of the new LASTFIRE foam test. LASTFIRE stands for Large Atmospheric Storage Tank Fires. It is a major project carried out by a consortium of sixteen oil companies (including BP, Shell, Exxon-Mobil and Total) to review the risks associated with large-diameter floating roof storage tanks. It is co-ordinated by the independent fire protection consultancy Resource Protection International (www.resprotint.co.uk). The original study is now being updated to include other tank construction types.

The LASTFIRE test is the world's first ever foam test specifically designed to simulate the unique conditions

Picture courtesy of Resource Protection International

Picture courtesy of Resource Protection International

encountered in storage tank fire fighting. Every aspect of the test is designed to reproduce the way foams are applied in real-life, and to subject their performance to the most rigorous scrutiny. Only the best foams that have been specifically formulated for tank fire fighting can achieve high scores.

COLOSSAL DIMENSIONS

Perhaps the most distinctive characteristic of tank fires is their colossal size. The average diameter of a bulk hydrocarbon storage tank is 60 to 75 metres, with the largest being around 110 metres (360 ft). That's a surface area of 9,500 m^2, which is more than two football pitches! For this reason, foam must be capable of travelling long distances over a burning liquid surface. The LASTFIRE test pan simulates this by incorporating obstructions that not only hinder the flow of foam and so force a longer travel distance, but also provide localised hot spots that can cause premature breakdown of the foam and permit re-ignition.

SEARING HEAT

Experience has shown that tank fires often burn for hours or even days before adequate resources can be mustered to launch an effective foam attack. This can lead to the deep layer of fuel reaching extremely high temperatures. The fuel in the LASTFIRE test is made extra hot by using a long "pre-burn" time before the foam is applied, placing obstructions in the test pan to prolong the extinguishment time, and using high metal sides to trap the heat. Temperatures as high as 300ºC have been reached during LASTFIRE testing.

EDGE-SEALING

High vapour pressures around the periphery of the burning fuel along with hot "cherry red" tank shells and obstructions make it extremely difficult to achieve complete extinguishment. In the LASTFIRE test, a lighted torch is passed around the edge of the foam blanket to check for any pockets of uncovered fuel and vapour release where the fire might re-ignite. The obstructions in the test pan also create hot spots and corners that really test the edge-sealing capability of a foam to the full.

FUEL PICK-UP

Foam manufacturers advise fire fighters to apply foam gently in order to minimise contamination of the foam by the fuel. However, foam applied to a tank fire "over the top" from ground-based monitors is inevitably plunged forcefully into the burning fuel. The LASTFIRE test simulates this vigorous mixing by applying foam directly into the fuel, rather than applying it against a back-board as in other tests. It also recognises the wide variety of foam-making equipment that is used at tank fires. No less than three types of test nozzle are employed to mirror the foam properties produced by large-capacity aspirating "Colossus" type monitors, large-capacity semi-aspirating (also called non-aspirating) monitors, and fixed foam system pouring nozzles.

VAPOUR SUPPRESSION

Hot fuel at tank fires can lead to flammable vapours percolating through the bubbles to burn in and around the foam blanket. LASTFIRE tests the vapour suppressing capability of foam by passing a lighted torch around the foam blanket to check for any signs of re-ignition, ghosting or flashover.

Massive hydrocarbon tank fire in Middle East

BURNBACK RESISTANCE

Once a tank fire is out, it is essential that the foam prevents it from re-igniting and burning back. This is especially important if on-scene supplies of foam concentrate are running low or exhausted. The LASTFIRE test measures the ability of a foam to prevent re-ignition and burnback by re-igniting a small area of fuel and recording the extent of burnback. Foams that perform well prevent the spread of fire even after a long waiting period.

POOR PERFORMING FOAMS

A foam tested using the LASTFIRE protocol can achieve a maximum of 300 points. 70% of this score relates to extinguishment, 15% to vapour suppression, and 15% to burnback resistance. Depending on the test results, the fire performance of a foam is classified as Poor/Fail, Reduced, Acceptable or Good. Any foam capable of gaining acceptable and good categories in the LASTFIRE test can be used with confidence on large hydrocarbon storage tank fires.

Notable among the poor performing foams in the LASTFIRE test is the Aqueous Film-Forming Foam (AFFF) type. This is perhaps not surprising since AFFF was developed for use on aircraft crash fires. These are shallow spill fires that burn for only a few minutes before foam is applied. They could hardly be more different to bulk storage tank fires!

AFFF is specially formulated to collapse and lose its water content quickly in order to form a thin aqueous film that races ahead of the foam blanket to provide rapid flame knockdown. On tank fires, however, film-formation does not occur. The film is prevented from forming by the high temperature of the fuel. The residual AFFF foam blanket offers only weak fire fighting performance since its detergent ingredient has an inherently low resistance to heat and a tendency to emulsify with the fuel.

While AFFF was recommended for bulk tank fires by some organisations back in the 1970/80s, this is no longer the case. Alcohol Resistant versions of AFFF are today used by some oil companies for bulk storage tank fire

Angus Colossus large-capacity aspirating monitor in action on hydrocarbon storage tank fire in Middle East

Fire out!

protection. Developed over forty years ago, AFFF is today used principally by airport fire services. However, even in this application it has been superseded in many countries by the more advanced Film-Forming FluoroProtein (FFFP) such as Petroseal from Angus Fire.

FLUOROPROTEIN THE RIGHT CHOICE

Testing to the LASTFIRE protocol to date has found that the best foams for tank fire fighting are FluoroProtein (FP) foams and the more expensive Alcohol Resistant Aqueous Film-Forming Foams (AR-AFFF) and Alcohol Resistant Film-Forming FluoroProteins (AR-FFFP). However, an important distinction made by the LASTFIRE test is that there is a wide variation in the quality of commercially available products in each category. Just as it is possible to make top quality products, it is also possible to make cheap down-market versions by reducing the quantity and quality of key ingredients in all foam categories. As always, you get what you pay for!

A modern high-performance Fluoro-Protein foam like Tankmaster (formerly FP70 Plus) from Angus Fire passes the LASTFIRE test with flying colours. It clearly demonstrates all the key charac-teristics identified by LASTFIRE for good fire performance.

- It travels over 90 metres when produced with good quality foam equipment.
- A protein-based "skeletal" structure inside its bubble walls provides exceptional resistance to heat, enabling it to pass through flames, impact on hot fuel, and move over burning liquid surfaces without any significant fuel pick-up.
- Its bubble walls are tough enough to overcome high fuel vapour pressures and seal tightly against even the hottest metal surfaces.
- Its detergent-free formulation makes its bubbles inherently fuel repellant, enabling it to tolerate even the most vigorous mixing with hydrocarbon fuel.
- It suppresses vapours by forming a tough cohesive blanket that does not permit vapours to pass through it.
- Unique water retention properties mean that water is released evenly and efficiently over the whole surface area of the fuel, cooling the deep layers of hot fuel and so pre-venting re-ignition and burnback.

COST CONSIDERATIONS

LASTFIRE testing has shown that the principal realistic alternative to a modern high-performance FluoroProtein (FP) foam for tank fires in terms of fire fighting performance is a good quality AR-AFFF such as Tridol ATF from Angus Fire. However, AR-AFFF becomes a less attractive option when other factors are considered. Principal among these is cost since AR-AFFF is much more expensive than FluoroProtein. This is because its price includes extra ingredients for alcohol resistance and film-formation, neither of which are necessary for hydro-carbon storage tank fire fighting.

SHELF-LIFE

A key ingredient in AR-AFFF is a "poly-mer" that enables it to be used on water-soluble flammable liquids such as alcohols. Polymer not only makes

Picture courtesy of Resource Protection International

AR-AFFF more expensive than FluoroProtein, but it can also give rise to storage problems. Polymer is a thick, gummy material that makes AR-AFFF highly viscous. At best it is like honey, and at worst like wallpaper paste! All too often, this leads to inaccurate proportioning, especially at low temperatures. Low quality AR-AFFF is also susceptible to "polymer drop-out" while in storage, which renders the foam useless by turning it to jelly. FluoroProtein foams do not suffer any of these storage problems simply because they do not contain any polymer that could potentially drop out.

ENVIRONMENTAL IMPACT

Another factor that cannot be ignored today is the environmental credentials of a foam concentrate. This is particularly important in storage tank fire fighting, where the huge quantities of foam used may impact on refinery wastewater treatment plants as well as the local water environment.

This is another area where FluoroProtein has the edge over AR-AFFF. The main ingredient in FluoroProtein is a natural and renewable organic protein source. It does not contain any of the man-made detergent or glycol ether chemicals found in AR-AFFF, and its fluorocarbon content is also much lower, telomer-based, and PFOS-free.

FluoroProtein is less toxic than AR-AFFF to creatures in the water environment and bacteria in biological wastewater treatment plants. The presence of detergent in AR-AFFF means that it is more prone to disrupt the operation of oil separators by allowing fuel emulsified in the foam to escape into the local water environment and cause pollution. Bacteria in the environment have had millions of years to get used to breaking down natural protein, unlike the man-made chemicals in AR-AFFF. It is difficult to improve on Mother Nature herself!

THE WAY FORWARD

The new LASTFIRE foam test is a major step forward in helping tank operators to select the right foams for large-scale hydrocarbon storage tank fire fighting. In fact, many tank operators have already added a LASTFIRE test certificate to their foam purchasing specification.

LASTFIRE testing has shown that currently the best performing foams for hydrocarbon tank fire fighting are high quality FluoroProteins (FP), AR-AFFF and AR-FFFP. However, when cost, shelf life and environmental impact are taken into consideration, then modern high-performance FluoroProtein clearly emerges as most user's obvious choice. Of course manufacturers are continually striving to develop and improve products. Although no small scale test can ever fully simulate all the conditions of a large diameter full surface fire, the LASTFIRE test can be used to help evaluate these developments specifically for tank fire applications.

FluoroProtein was specifically developed for use on storage tank fires, and is already extensively used by oil companies around the world. While some have investigated the AR alternatives, most have chosen to standardise on top performing FluoroProtein. The cost savings made can be used to purchase other crucial items of equipment such as Hi-Vol large-diameter hose systems that provide the efficient water supply logistics needed for a successful foam attack.

Passive Fire Pro

Insuring Their Role in a Bala

A BALANCED FIRE PROTECTION design incorporates both active and passive fire protection systems working in concert to minimize the effects of fire on life safety and property. Active fire protection systems, such as automatic suppression and detection systems, detect, alert, control, and extinguish a fire in its incipient stages.

By Arthur J. Parker, P.E.
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Passive fire protection systems, such as fire resistance rated boundaries, through-penetration fire stop systems, and fireproofing materials, limit the spread of fire (and smoke) beyond the room or area of origin by containing the fire. Building codes recognize the importance of this balanced design approach by requiring minimum fire resistance ratings for structural building and separation elements (floors and walls), and the installation of active fire protection systems (in most occupancies). The intent is to limit the risk to life and property to an acceptable level by requiring somewhat redundant safety systems.

Passive fire protection systems must be inspected at the time of installation to insure the highest level of initial reliability. A regular inspection and maintenance program assures continued reliability of the passive fire protection system over the life of the building. Initial inspections are typically provided for in the building code through special inspections or requirements for the installation of certified resistance rated assemblies. Regular inspections and maintenance are not typically required by the building codes, rather by the insurer of the building, with the frequency depending on the insurance underwriter and/or the type of occupancy.

The only installed passive fire protection material currently subjected to special inspections in the U.S building codes is sprayed fire-resistive materials (SFRM). Other products, such as thin-film intumescents, through-penetration fire stop systems, gypsum wallboard, concrete masonry units (CMU), fire doors and glazing materials are typically only subjected to inspections by the local building official after installation as a system or assembly before final building sign-off is obtained. In order to function as required, each of these products must be installed per the certification requirements and the manufacturer's installation instructions.

Passive fire protection systems must be inspected at the time of installation to insure the highest level of initial reliability. A regular inspection and maintenance program assures continued reliability of the passive fire protection system over the life of the building.

Inspection of installed SFRM are conducted using field testing standards which verify that the minimum SFRM density, thickness, and adhesion/cohesion (bond strength) performance parameters have been met. The American Society for Testing and Materials (ASTM) and the Association of the Wall and Ceiling Industries – International (AWCI) have developed test standards for conducting field tests of SFRM installed on building structural steel to verify the performance parameters specified by the certification agency have been met. AWCI has also developed a test method for conducting field testing of the installed thickness of thin-film intumescent materials.

Currently, U.S. building codes do not include special inspection requirements for verifying the installation of field installed through-penetration fire stop systems. However, ASTM has developed a standard practice which provides guidance for conducting field inspections of installed fire stop systems to insure their installation is in accordance with the certification requirements and the manufacturer's installation instructions. Procedures for conducting destructive tests on a small percentage of each unique type of installed fire

tection Systems

nced Fire Protection Design

stop system per floor or minimum floor area for larger buildings, or witnessing the new installation of these products are provided. The incorporation of this test method into the building codes may occur in the near future, thus providing another standardized inspection method for common passive fire protection materials. In general, all SFRM, thin-film intumescent, and through-penetration systems rely on random testing by independent third-party organizations, hired by the building owner or general contractor, to verify their proper installation.

Fire doors are required to be provided with an approved and permanently affixed labele showing the name of the manufacturer, the name of the third-party certification agency, and the fire protection rating of the door assembly.

For other types of passive fire protection systems, such as floors, walls, doors, and glazing materials where a fire resistance rating is required, the inclusion of a recognized third-party certification mark is required to be provided on the product(s). On gypsum wallboard, the inside surface of each board is stamped with a label providing manufacturer information and the type of wallboard. For concrete masonry units (CMU), certification paperwork must be attached to all materials, insuring only tested and certified CMU is being used.

Fire doors are required to be provided with an approved and permanently affixed labele showing the name of the manufacturer, the name of the third-party certification agency, and the fire protection rating of the door assembly. When specific temperature limits are required, such as when the door is installed in an exit enclosure, the maximum transmitted temperature end point is also required to be included on the label. The label is required to be applied at the factory or location where fabrication and assembly are performed to insure the door delivered to the job site was manufactured under strict quality control procedures and was not field altered.

Glazing materials are required to bear a label indicating if the glazing assembly can be used as a fire resistance rated assembly (such as in a wall), a fire door assembly, or in an opening. This label also insures that the assembly meets the applicable fire resistance requirements, performance in accordance with the hose stream requirements (if required), and the fire protection rating period. This information is required to be permanently etched into the edge of the glazing material to insure that any material delivered to the job site will bear an indelible identifying mark indicating that it is a fire rated material.

Glazing materials are required to bear a label indicating if the glazing assembly can be used as a fire resistance rated assembly (such as in a wall), a fire door assembly, or in an opening.

Passive fire protection materials play an important role in the balanced design process. The use of consensus developed test standards, field testing procedures, certification programs, and routine inspection and maintenance program insures, the proper installation and operation of passive fire protection materials can be assured for the life of the building.

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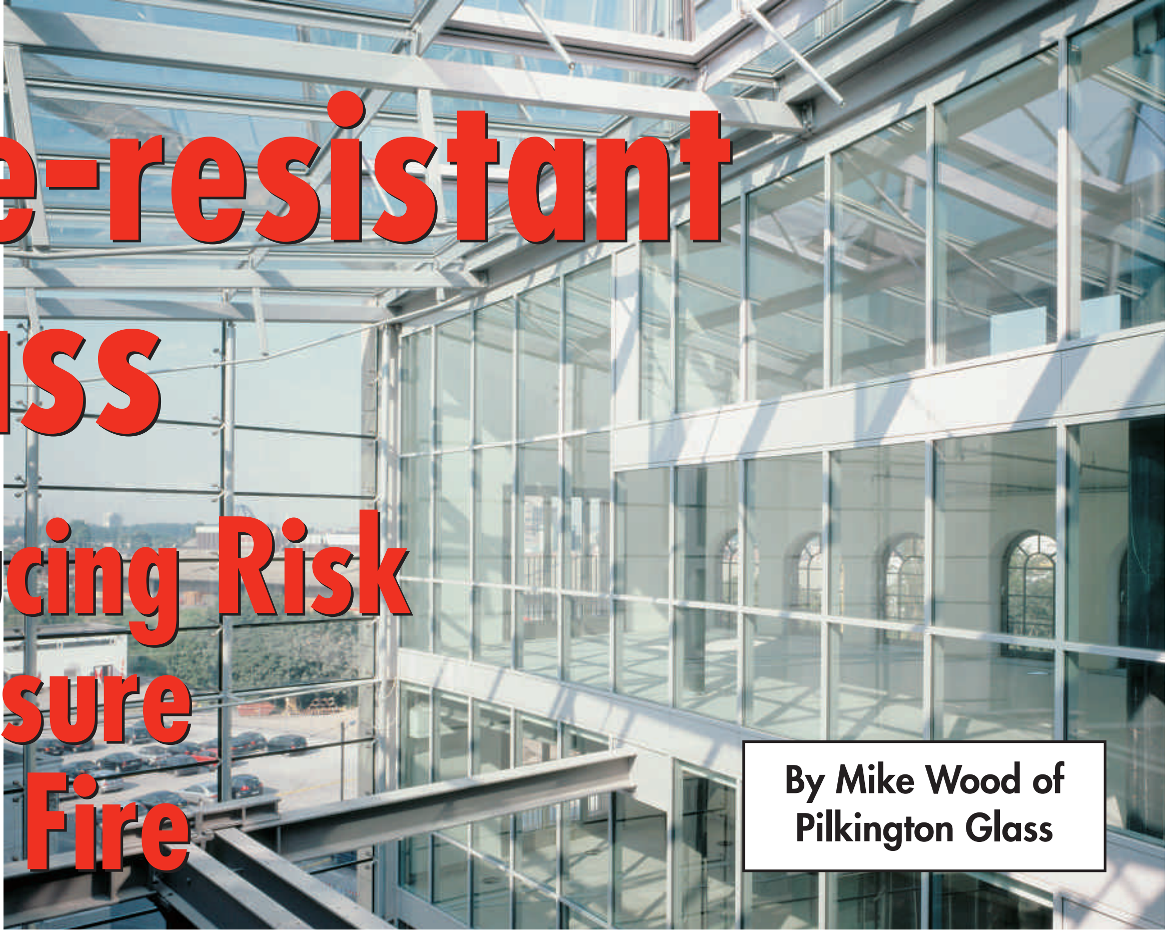
Reducing Risk Exposure from Fire

By Mike Wood of Pilkington Glass



Pic courtesy of Pilkington Glass

NEW PERFORMANCE-BASED APPROACHES TO fire safety design require a different way of evaluating fire-resistant products and systems. The complexity of the modern built environment is causing the traditional prescriptive approach to fire protection design to be questioned in favour of a more flexible, but focused, risk assessment based regime.

Such a risk-based approach seeks to develop a tailored fire protection strategy based on the individual building's profile and the fire hazard that it may face. Concerning products and systems, it leads to a concentration on fitness for purpose. In following this approach, there are, therefore, fundamental implications for the way that fire-resistant products and systems need to be evaluated for use in buildings. A wider consideration of likely product performance in the conditions produced by real fires is required, rather than just an ability to meet an arbitrary pass-fail criterion in a standard furnace test which is intended more to classify products into generic performance categories than to reproduce performance in a fire.

IMPLICATIONS OF A RISK-BASED APPROACH

Passing a formulised furnace classification test on one occasion, or on only a handful of occasions, can be questioned regarding its ability to provide a sufficient level of confidence in product performance in real fire situations. Passing the test should not be taken, either implicitly or explicitly, as a guarantee of a certain level of performance in a real fire. In particular, consistency of performance, and hence reliability under a range of different potential fire conditions, cannot be readily derived from black and white pass/fail criteria in individual furnace tests. In this respect, assessments *in lieu* of fire test results with only a fragile connection to relevant test data I n particular should be critically looked at regarding performance reliability and consistency.

As the destruction by fire of the Windsor building in Madrid illustrates, modern synthetic fittings and furnishing can lead to fierce and aggressive fire environments with temperature-time profiles substantially different from that of the standard ISO 834 test curve. Not only does the standardised time-temperature profile in the furnace test not necessarily replicate fire conditions, but product and systems are routinely tested in isolation as separate elements rather than as components in a connected structure.

NIST REPORT ON THE LESSONS FROM 9/11

The recently published report by the US National Institute of Standards and Technology (NIST) on the World Trade Centre disaster highlights this question. The report calls for the fire performance of structures to be evaluated in a more holistic way and recommends that product testing be more critically evaluated. NIST specifically proposes that the technical basis for the century-old standard for the testing of fire resistance needs to be improved, especially regarding extrapolation of test results to applications in real buildings.

If the NIST call is to be answered then the evaluation of the fire performance of products and systems needs to be based on a more rigorous scientific approach. This should include an evaluation of the underlying product technology, in combination certainly with an extensive history of standard furnace tests. Both non-standard tests, as appropriate, and real fire post mortem studies should also be included within the product evaluation. The objective of such a wider evaluation should be to demonstrate failure mechanisms and to identify the key limitations of the technology in fire conditions to a sufficient degree to enable informed technical judgments on performance to be made with confidence. The key to the new risk-based design regime is therefore an evaluation of the robustness of the product technology – that is, its ability to cope safely with a range of potential fire environments – rather than single

Fire-resistant Glass

Reducing Risk Exposure from Fire

product test results taken in isolation, as is currently the most common practice.

A review of glass in fire can serve as a good example of the type of approach that will need to be adopted.

PERFORMANCE OF GLASS IN FIRE

Glass is not naturally resistant against fire. It is transparent to heat radiation and readily cracks under thermal shock. Standard annealed flat glass products typically fail integrity within about 5 to 12 minutes under fire conditions. The main threat is thermal stress causing multiple cracking. A rise of temperature as little as 80°C may be sufficient to cause cracking but there is a distinct probability of failure over a range of temperatures. Pane size, framing conditions, and critically surface quality, determined by handling and processing history, are all important factors in determining how the glass will react when exposed to fire. Because of the fundamental nature and structure of glass, prediction of failure is inherently uncertain. Double glazing may delay the onset of failure, dependent on circumstances, but this is not generally significant in terms of improved integrity performance.

If there is a risk of water impingement on hot glass (e.g. from sprinklers) then it is *absolutely* critical that the coverage is even and continuous over the surface of the glass from the beginning of a fire. However, these ideal conditions are difficult to achieve in practical glazed situations, where fittings, furnishings, mullions and transoms, in particular, cast shadows across the glass, preventing even water coverage.

TOUGHENED GLASS & SAFETY LAMINATED GLASS TECHNOLOGIES

Thermally toughened glass for impact safety can be susceptible to unpredictable, catastrophic failure in case of fire: a temperature shock as little as 200°C may be sufficient to cause failure. In case of failure then the glass pane disintegrates into a pile of pieces. As an impact safety technology, that is what it is designed to do.

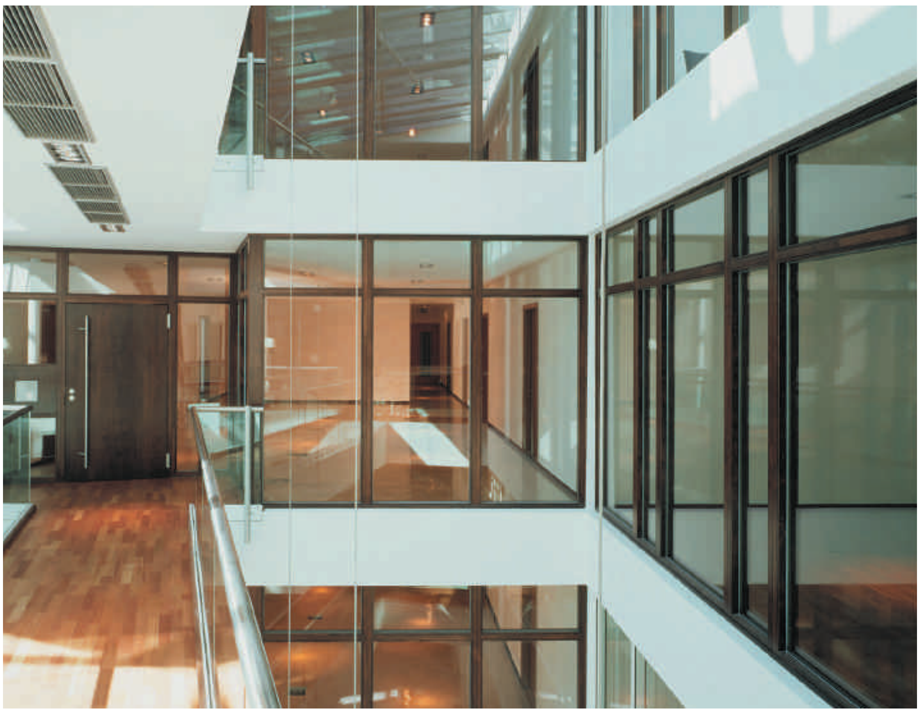
Even modified soda lime toughened glass for fire resistance has to be used under very carefully controlled conditions to minimise the risk of failure. Localised heating is a particular threat to glass integrity and sensitivity to framing and surface condition is particularly high. For example, there has to be a maximum of edge cover for the glass when framed (typically 10mm maximum) and performance can critically depend on the use of the right type of glazing seal. Furthermore, if the glass should survive the initial shock then heating in a fire causes a relaxation of the toughened stress and the product may substantially lose its impact properties. On this basis, toughened glass can be said to be a product of uncertain safety in case of fire, one with a performance that may providentially depend on favourable circumstances and conditions.

Glass laminated with a plastic pvb (i.e. polyvinylbutyral) interlayer designed for impact and security properties also has limited integrity under fire conditions. Tests show that this type of interlayer under fire conditions melts at temperatures in the range 120°C to 140°C, and may ignite. It can burn or give off large amounts of smoke. Just because the product is laminated and has good impact performance does not mean that the plastic interlayer provides good fire resistance performance. In a fire test, such products deteriorate rapidly in around 5 to 8 minutes at interlayer temperatures below 300°C.

FIRE-RESISTANT GLASS TECHNOLOGIES

Fire-resistant glazing requires the development of special technologies given the fundamental nature of glass and the range of possible fire conditions possible in modern buildings.

Fire-resistant glass products are available that can provide protection in terms of either basic “integrity” (which means that the glass acts as a barrier to prevent fire movement) or “integrity and insulation” (which means that the glass provides a physical barrier as well as preventing the transmission of heat from the fire). But, classification into these broad performance categories



Pic courtesy of Pilkington Glass

Pic courtesy of Pilkington Glass

hides a range of differences between the various glass technologies that may be used for fire-resistant glass, which give rise to relative differences in sensitivities to fire that under some circumstances can lead to significant differences in performance in real fires.

It would be a fundamental mistake to assume that all fire-resistant glass products alike. They are not. In fact there are quite major differences in important points of detail, even if the glazings may have at face value the same performance classification. Above all, what is achievable with one fire-resistant glass may not be achievable with another. Tested approvals apply to particular configurations, glazing sizes, aspect ratios, material combinations, particular framed systems and applications.

Pic courtesy of Pilkington Glass

In a risk-based approach to fire protection, it is apparent that some fire-resistant glass types are simply more tolerant than others of the range of possible fire conditions, because of fundamental differences in the robustness of the underlying technologies. The superficial label "pyro" attached to different products does not automatically mean an equivalent level of performance in terms of robustness to fire conditions, reliability and consistency. Very careful consideration has to be given to each product type and its underlying technology to identify its capabilities and range.

Wired glass, for example, is a basic and traditional fire-resistant glass technology with a pedigree stretching back more than one hundred years. It is based on the concept of reinforcement, known since man first made mud bricks containing chopped straw. In a fire, the integral wire mesh within the body of the glass holds the glass together, retaining the pane in place as an integrity barrier. But, it remains as a clear glass with only limited performance in terms of restricting radiant heat. Toughened borosilicate technology is similar: a clear glass with a good resistance to thermal shock based on a low expansion glass composition which limits thermal stresses.

One of the most robust fire-resistant glass technologies is provided by a special inorganic intumescent interlayer between annealed glass sheets in a sandwich laminate structure. Such a flexible technology can be used for both integrity and integrity with insulation performance over a wide range of temperatures, times, systems and applications. The function of the special interlayer system can be guaranteed in case of fire: it turns opaque, releases steam, absorbs heat and intumesces to give a stable foam structure. The interlayer cuts down radiant heat to tolerable levels, insulates and holds the whole structure together as a resilient integrity barrier against fire. Pilkington **Pyrostop**™ and Pilkington **Pyrodur**™ have been used in buildings for around 30 years. They have been extensively tested in a variety of systems around the world in that time, have been put to the test in large scale non-standard arrangements and have been evaluated in real fires. They are continually tested and developed to meet the needs of modern fire protection.

The need for high performance fire protection in the built environment is increasing. Our cities are becoming more complex and increasingly congested. When free space is at such a premium, and when planning objectives seek to minimise environmental impact through spreading urban sprawl, then the only way to build quality living and working space is upwards. The city landscape is therefore made distinctive the world over by high rise buildings, getting increasingly taller, bringing their own particular set of challenges due to risks from fire. Within the context of economic prosperity, commercial growth, and quality of life, the built environment is also critically more important as a foundation for sustainable, socially diverse communities. In this modern urban context, therefore, the impact of fire is more than just a question of life safety.

Against this background, performance and risk-based fire protection design will have an increasing role to play. And this means that we have to look at our products and systems in a different way with much more of a focus on reliability and consistency under real fire conditions.

Mike Wood has a background as a development glass technologist at Pilkington, of more than 30 years' standing. He is a specialist in fire-resistant glass and currently chairs a number of leading UK representative fire protection groups: the Fire Resistant Glazing Group of the Glass and Glazing Federation, the Fire Safety Development Group, and the strategy task group of the Passive Fire Protection Federation.

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Halon and the search for a sustainable replacement

By Andrew Shiner

Pic courtesy of Tyco Fire & Security

HALON 1301 WAS USED around the world to protect what, with the arrival of the telecommunications and computer age, came to be known as business critical assets – manned telecommunications centres and computer suites, upon which many corporations rely for their very existence. It was also extensively used to safeguard art galleries, museums and document archives, as discharge of the Halon gas resulted in no damage being caused to the sometimes-irreplaceable works of art.

It was a first rate fire suppressant. Unfortunately, the same could not be claimed for its environmental credentials. Halon 1301 had ozone depletion potential, global warming potential and an atmospheric lifetime that was wholly unacceptable.

So the demise of Halon 1301, following the signing of the Montreal Protocol on Substances that Deplete the Ozone Layer back in the late 1980s, had chemists around the world – particularly in the USA – devoting thousands of man-hours in the search for a sustainable, environmentally acceptable and long-term alternative. Their aim was to develop a suppressant that, while satisfying the needs of the fire industry, would allay the real and vociferous concerns of environmentalists.

Ironically perhaps, studies have indicated that the types of application for which Halon 1301 was used represents no more than three percent to four percent of the overall firefighting market. However, the significance of the Halon phase-out lay in the damage that a fire in a business-critical asset environment or a heritage site can cause.

To cite just one recent example that puts the challenge into sharp perspective, as recently as September 2004, some 25,000 books were destroyed and a further 40,000 were damaged by smoke and water – no doubt used to suppress the fire – in a fire in the Duchess Anna Amalia Library housed in a 16th-centry rococo-style palace in Weimar, Germany. Christina Weiss, Germany's Culture Minister, understandably called the fire "a national culture catastrophe and a great loss for world heritage."

INDUSTRY'S FIRST RESPONSE

Halocarbons – Halon-like compounds – generically know as HFCs, were the industry's first response to the need for alternatives to ozone depleting agents. Some proved effective and were adopted by the fire industry and building occupiers, while others failed due either to their inefficiency as a firefighting agent, or their toxicity. In reality,

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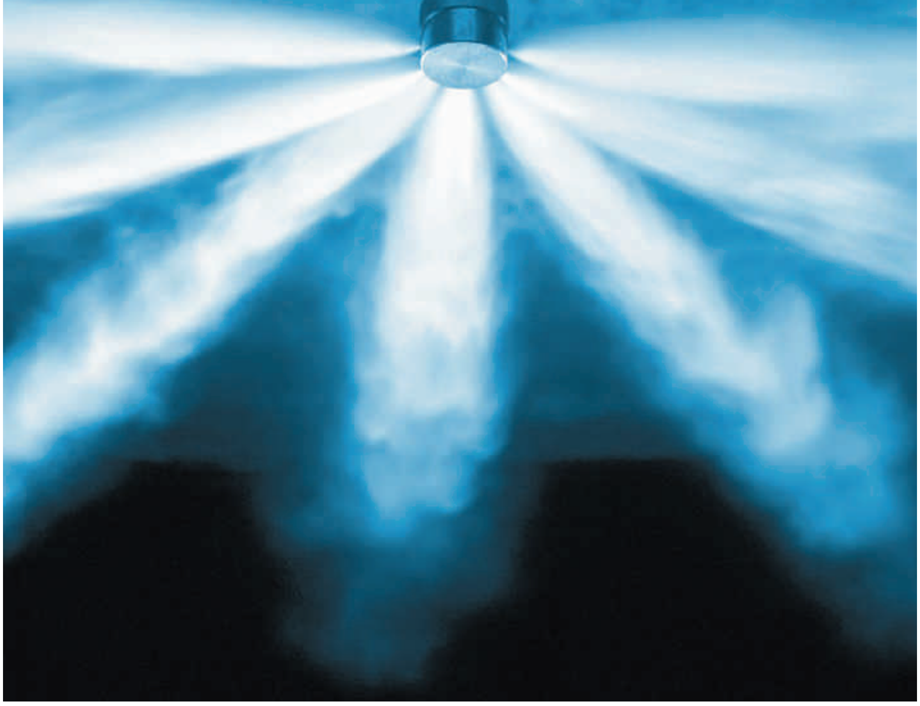

Pic courtesy of Tyco Fire & Security

they often turned out to be solutions that did not live up to their early expectations.

The more successful and acceptable were broadly embraced, and it is beyond dispute that their availability on the market assisted the Halon phase out programme, and powered the transition away from ozone depleting substances. The important point, however, is that these agents were not without an environmental downside. Without exception, all had significant global warming potential.

The fact that global warming results in climate change is now widely accepted. So much so, that the Kyoto Protocol (or to give it its full title, the Kyoto Protocol to the United Nations Framework Convention on Climate Change) has, as its goal, the reduction of greenhouse gas emissions. Rainfall patterns are changing, as is evidenced by the increased flooding in many parts of the world; sea levels are rising; glaciers are retreating; polar sea-ice is thinning; and the incidence of extreme weather is increasing in some parts of the world. If this trend continues, it is inevitable that there will be permanent flooding of many low-lying areas. Heat waves have proved fatal to the old and infirm, and there are real concerns that heavy rainfall can increase the incidence of water-borne diseases.

THE INERT GAS OPTIONS

The industry's answer to the global warming challenge was inert gases, as they have precisely the environmental credentials that the market was seeking – zero ozone depletion potential, zero atmospheric lifetime and zero global warming potential – and represent the market's first truly sustainable "clean" fire suppression technology. Inert gases are non-toxic, they will not harm sensitive electronic equipment, art treasures or documents, and are safe to use in enclosed areas where people may be working.

These gases are a non-conductive and non-corrosive blend of naturally occurring gases – such as a combination of Nitrogen, Argon and Carbon Dioxide – or, less frequently, a single naturally occurring gas. Inert gas suppression systems, such as Tyco's new i3 system, work by lowering the oxygen content of the protected area to a point that will not support combustion, but is sufficient to sustain human life. This, it is important to bear in mind, is unlike Carbon Dioxide systems that, when used at design concentration, are lethal to room or enclosure occupants.

While welcoming inert gases' environmental characteristics, the market identified certain factors that, once again, focused the industry's attention on finding a chemical replacement for Halon 1301. These factors included the demand for substantially more space to store the suppressant's cylinders and, a requirement for more onerous venting. Taking, as an illustration, an installation where Halon 1301 would have required two cylinders, most HFC systems require little additional cylinder storage space. Inert gas systems, by comparison, can call for up to seven times the space of a comparable HFC system.

However, to organisations where specifying a non-chemical suppressant is of overriding importance, where storage space is not a determining factor, inert gases remain an attractive option. But, there was clearly a strong desire in the market for a new chemical fire-extinguishing agent, one with the advantages of the early Halon-like alternatives, and with the environmental profile of the inert gas systems. In short, a chemical system to complement the inert gas systems already on the market.

THE SUSTAINABLE CHEMICAL REPLACEMENT

The latest solution meets all of the market's requirements and is the result of more than four years concentrated effort and testing. It is a high performance fire-extinguishing agent that has a negligible impact on the environment and is designed to protect essential and delicate telecommunications and data processing equipment, plus it has applications within the cultural heritage sector protecting artefacts that would otherwise be destroyed by water from traditional sprinkler systems. This solution has an insignificant global warming potential, lower than any of the halocarbon agents acceptable for use in occupied spaces. In a word, the solution is sustainable.

It is a fluid-based system that uses long-term technology that not only satisfies today's regulations, it also meets all of those in the foreseeable future. It utilises new technology and has several

To organisations where specifying a non-chemical suppressant is of overriding importance, where storage space is not a determining factor, inert gases remain an attractive option.

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Halon and the search for a sustainable replacement

advantages over other Halon alternatives, or extinguishants currently on the market with unacceptably high global warming potential. International certification of new fluid-based system includes LPCB approval and UL listing. FM approval is imminent, following the successful completion of testing.

Pic courtesy of Tyco Fire & Security

Installations of the new system, called Sapphire, have a footprint similar to that of chemically-based clean agent systems, the lowest level of design concentration and the highest safety margin of any viable Halon 1301 or chemical alternative. The suppressant also has impressive "environmental footprint" credentials with zero ozone depleting potential and a remarkably low atmospheric lifetime of just five days. This compares with an atmospheric life for Halon 1301 of an astounding 107 years. Significantly, it is not included in the basket of greenhouse gases identified by the Kyoto Protocol.

To put this into perspective, the fluid has a global warming potential of just "one". Compare this with a not untypical HFC, HFC 125 (that, incidentally has a atmospheric lifetime of 33 years, against the new fluid's five days) and for the release of just one kilogramme of the HFC, 2,800 kilograms or 2.8 tonnes of the fluid would have to be released to have the same impact on climate change.

The Sapphire fluid is stored in cylinders as a low vapour pressure fluid that transmutes into a colourless and odourless gas when discharged. Unlike other fluid fire extinguishing agents, it can be used with absolute confidence to suppress fires involving electronic, computing or communications equipment. This has been graphically demonstrated by immersing a laptop computer into a tank of the fluid and showing that, not only does the laptop still work after the dunking, it works while it is still immersed in the tank. Similarly, the suppressant's suitability for protecting archives and museums has been established in similar witnessed trials that prove that a document can be immersed in the fluid without damaging it, or even causing the ink to run!

Typical total flooding applications use between just four and six percent by volume of the fluid, which is well below the agent's saturation or condensation level and, when discharged, the agent is dispersed through natural ventilation, leaving no residue to damage sensitive electronic equipment; it is also non-conductive and non-corrosive.

One of the significant attractions of Halon 1301 was that it was seen to be safe for humans at normal use concentrations, which lead to its acceptance for use in occupied spaces. However comparing the gases' NOAEL or No Observed Adverse Effect Level with its normal design concentration of five percent clearly shows that Halon had no safety margin. While certain HFCs and inert gases are used at design concentrations that are below the NOAEL, with safety margins that range from seven percent to 20 percent, no other Halon alternative comes close to the new fluid systems 92 percent safety margin.

An inevitable consequence of the signing of the Montreal Protocol was that Halon installations around the world have been replaced with alternatives systems. However, during the intervening years, environmental concern continued regarding many of the first generation replacements. Companies about to commission new installations are understandably anxious to ensure that they do not run the risk of choosing a solution that itself may face decommissioning a few years down the line. For them, long-term sustainability is the key issue, and one that is, for the first time, convincingly addressed by the new fluid-based system.

Andrew Shiner is Director, Marketing Europe, Middle East & Africa for Tyco Fire & Security's Fire Suppression Strategic Business Unit. Here he looks back over the past decade and a half, since the signing of the Montreal Protocol that rang the death knell for Halon as a fire suppressant, and charts the progress towards the industry's "Holly Grail" – a truly sustainable alternative.

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International Testing of Smoke, Heat, CO and Multi Detectors

By Bill Rossiter, Managing Director of No Climb Products

Pic courtesy of No Climb

A LEADING DETECTOR MANUFACTURER recently recalled thermal smoke detectors that had been manufactured over a period of several months last year. The recall was necessary because the internal contact of the thermal switch component might have an insulating film preventing the detector from reporting a heat alarm signal to the control panel. Fortunately the detectors could still have detected smoke and this is a reputable manufacturer whose follow up will be excellent.

Its occurrence, however, underlines strongly the need for proper functional testing – both at installation/commissioning/acceptance and, on an annual basis. This paper clarifies what this means, using examples from the national codes of the UK, US, France and Germany. Many other countries have similar requirements but some could be clearer than they are now. The above product recall emphasises why such standards need to be adopted where they do not yet exist, clarified where they are misunderstood and upheld and enforced where they already exist unambiguously.

A functional check involves a physical stimulus:

> *"In the case of detectors (all types) tests must ensure that products of combustion are capable of passing unhindered from the protected area to the sensing chamber/elements of the detector and not simply test the ability of the detector to sample/verify the status of the atmosphere already in the sensing chamber."*
>
> BS 5839 1: 2002 Clause 45.3, December 2004 update

The US code agrees:

> *"The detectors shall be tested in place to ensure smoke entry into the sensing chamber and an alarm response."*
>
> NFPA 72 National Fire Table 10.4.2.2 (g) Smoke detectors

Pic courtesy of No Climb

But the UK's code also explains what is *not* acceptable. A functional check is not something that can be conducted only by checking analogue values. Neither is it something that can be accomplished with a magnet:

> *"Since stimulus of the sensing element through introduction of the phenomena or surrogate phenomena which the detectors are designed to detect forms part of the test*(s)*, use of a test button or a test magnet (for example) or compliance with 45(i)* (confirmation of analogue values) *does not satisfy the recommendations. . ."*
>
> BS 5839 1: 2002 45.3 (Note 4)

In France Règle APSAD R7 Detection automatique d'incendie, Edition 02.1997.4 (fevrier 2003) also highlights the importance of a proper functional check:

> *5.2.2.3 Essai de fonctionnement des detecteurs*
> *L'essai a pour but de verifier la reponse de chaque detecteur a la grandeur caracteristique qu'il doit detecter.*

Or, put another way, the goal is to check that each detector has the capability of picking up that which it is designed to detect.

As to how the functional checks can be performed, R7 Section 5.2.2.3

Pic courtesy of No Climb

explains that the person performing the work should be equipped with:

> *". . . dispositifs necessaires non destructibles pour le materiel et compatible avec l'environnement des detecteurs pour produire les grandeurs caracteristiques d'excitation des detecteurs essayes (generateurs de chaleur, d'aerosols, de fumee, de rayons IR or UV, etc)"*

or translated 'the necessary non destructive tools for the job that are compatible with the detectors and produce the appropriate stimuli to activate the detectors under test (heat, aerosol, smoke, IR or UV generators.)'

In a harmony rarely seen among these four nations the Germans concur and DIN 14675:2003-11 states:

> *8.2 Überprüfung*
> *Die Funktionsprüfung der automatischen Brandmelder ist mindestens durch Simulation der relevanten physikalischen Brandkenngröße außerhalb des Melders durchzuführen (z.B. Verwendung von Prüfaerosolen für Rauch).*

which translated, means that the functional testing of the automatic fire detectors is, at the very least, to be carried out through the simulation of the relevant physical characteristics of fire outside of the detector (e.g. using test aerosols for smoke).

Extending this theme many national standards now refer not only to the need to check the device but also the need to avoid danger or other damage to – or from – the environment in which the detector is installed. This is encapsulated by the UK's BS 5839:

> *Every heat detector should be functionally tested by means of a suitable heat source . . . the heat source should not have the potential to ignite a fire; live flame should not be used, and special equipment might be necessary in explosive atmospheres.*
> BS 5839 1: 2002 Clause 45.4, December 2004 update

The French and British are of one mind and France's R7 states that devices producing live flames, such as lighters, are prohibited:

> *"sont exclus ici les generateurs a flamme vive tels que les briquets"*
> R7 Section 5.2.2.3

The theme of avoiding damage is also explicitly recognised for other detectors. Smoke detectors, for example, might react to various stimuli but setting them off properly with a genuine physical functional check is only part of the art. Avoiding damage to them (with less than the best detector testers for example!) is another. Again, this is picked up by the British Standard:

> *"Point smoke detectors should be functionally tested by a method that confirms smoke can enter the detector chamber and produce a fire alarm signal (e.g.: by use of apparatus that generates simulated smoke or suitable aerosols around the detector). It should be ensured that the material used does not cause damage to, or affect the subsequent performance of the detector . . ."*
> BS 5839 1: 2002 45.4 (d)

In fact BS 5839, having recently been reviewed (the last update was December 2004) is refreshingly clear in many areas. It encapsulates the various possibilities for problems when it talks of the need for proper testing of CO fire detectors.

> *"Carbon monoxide fire detectors should be functionally tested by a method that confirms that carbon monoxide can enter the detector chamber and produce a fire alarm signal (e.g. by use of apparatus that generates carbon monoxide or a gas that has a similar effect on the electro-chemical cell as carbon monoxide). WARNING: Carbon monoxide is a highly toxic gas and suitable precautions should be taken in its use".*
> BS 5839 1: 2002 Clause 45.4 (d), December 2004 update

As regards when all these tests should be conducted, the answer is both:

1) At commissioning
   and,
2) Annually (though the annual tests are often split over the course of two or more occasions).

In the US, National Fire Alarm Code NFPA 72 2002 Edition, Table 10.4.3 Testing Frequencies requires both Initial/Reacceptance and Annual functional checks. Similarly, the UK's National Code, states:

> *"At commissioning, the entire system should be inspected and tested to ensure that it operates satisfactorily and that, in particular, . . .*
>
> *1) all manual call points and automatic fire detectors function correctly in accordance with the recommendations in 45.4;*
> BS 5839 Part 1: 2002 39.2 c:

where 45.4 clarifies the 'physical nature' of the functional check.

Germany too requires, at commissioning, that 100% of all installed system components be tested and that, in the case of automatic fire detector tests, the alarm be triggered by simulating the characteristics of fire at the detector.

> *Anhang 1 – 1.2.5 Funktionsprüfungen*
> *Die nachfolgenden Funktionsprüfungen bilden den Abschluss der Inbetriebsetzungsarbeiten für eine BMA. Sie sollten daher als 100%-Prüfungen mit allen*

Pic courtesy of No Climb

installierten Anlagenbestandteilen durchgeführt werden . . . aller automatischen Brandmelder . . . sollten geprüft werden. . . . Für diese Prüfungen sollte die Alarmauslösung der automatischen Brandmelder durch Simulation der relevanten Brandkenngröße am Melder . . . vorgenommen werden."

DIN 14675:2003-11

In France Règle APSAD R7 Detection automatique d'incendie, Edition 02.1997.4 (fevrier 2003) also highlights the importance of the commissioning tests. In Section *5.2 Operation de visite de conformite* (the commissioning visit) it states:

5.2.2 Verification fonctionelle de l'installation
La verification fonctionelle d'installation a pour but de s'assurer que toutes les fonctions sont correctement remplies. . . .

And cross refers this, in 6.3.3, to the periodic annual checks (while confirming in 6.4 that that the annual checks can be split into two six monthly checks though, in common with most countries, indicating that the period must not be less frequent than six monthly).

Six monthly visits by a Competent Person to every detector are, of course, a wise step for a number of reasons. Not only can a proper functional check on an ongoing basis highlight the inability of a detector to raise an alarm (for reasons which may range from component failure through wiring damage to dust covers or other barriers to detection). It also provides an opportunity for an expert to assess building, usage and other changes that may impact the reliability or suitability of the detector relative to its installed environment.

So, with all this clarity, what confusion can remain?

One area concerns the ongoing sensitivity of a detector. This is something that cannot be assessed at all with most conventional detectors without a specialist test device. It is also one where even the faith in analogue detectors – assessing as they do only the sensors as opposed to the ability of them to receive stimuli – is flawed. As the French R7 notes (with reference to the functional checks):

5.2.2.3 Essai de fonctionnement des detecteurs
En aucun cas ce test ne doit etre considere comme une mesure de sensibilite . . . il ne peut etre confondu avec la verification du niveau de performance efffectuee au moyen des foyers-types de site.

Which translated, means that, in no instance can this (functional) test be mistaken for a sensitivity check nor confused with site performance checks (carried out separately and according to strict controls).

This, at least, goes to show that the French and Americans agree on some things – as the US Code NFPA 72 confirms:

> *"10.4.3.2.6 The detector or smoke alarm sensitivity shall not be tested or measured using any device that administers an unmeasured concentration of smoke or other aerosol into the detector or smoke alarm"*

and the American code is equally clear on how sensitivity checks can – and must – be performed as it is on how they cannot be:

> *10.4.3.2.4 To ensure that each smoke detector or smoke alarm is within its listed and marked sensitivity range, it shall be tested using any of the following methods:*
> *(1) Calibrated test method*
> *(2) Manufacturer's calibrated sensitivity test instrument*
> *(3) Listed control equipment arranged for the purpose*
> *(4) Smoke detector/control unit arrangement whereby the detector causes a signal at the control unit where its sensitivity is outside its listed sensitivity range*
> *(5) Other calibrated sensitivity test methods approved by the authority having jurisdiction*
> *10.4.3.2.5 Detectors or smoke alarms found to have a sensitivity outside the listed and marked sensitivity range shall be cleaned and recalibrated or be replaced.*

Finally, the other area looking for clarification is that of multi sensor detectors. Or multi criteria detectors (even the names and definitions are not clearly understood or agreed). In the opinion of the author the 'multi confusion' has a 'single clarification' – that, for the purpose of field testing it does not matter whether one defines them as multi criteria or multi sensor. Neither does it matter how they are configured or when. Wherever possible (sometimes limited by the test modes available) each of their separate sensing abilities must be tested in the same real functional manner and at the same (commissioning and annual) times as described throughout this document. The logic behind this, however, needs another paper. . .

Bill Rossiter is Managing Director of No Climb Products, the world leading manufacturer of Solo and Trutest detector testers and winner of the Queen's Award for Enterprise. Bill is also Chairman of SDI in New Jersey, USA (No Climb's US operation) and Chairman of the BFPSA Technical Working Group on Maintenance and a member of both FD&A Executive committee and the Council of the BFPSA. The company designs, manufactures and supplies detector testers ranging from field testers to laboratory smoke tunnels directly to over 50 countries.

www.detectortesters.com

FM Approvals Readi Water-Mis

MORE THAN 10 YEARS in the making, the soon-to-be-released "Approval Standard for Water-Mist Systems" (5560), from FM Approvals, is big, not only in size, but also in its potential impact on an industry that's still in its infancy. Although water-mist fire extinguishing systems have been in use for decades on ships and in other specialized applications, true commercial interest didn't take off until the 1993 ban on halon gas extinguishing agents made water mist a viable alternative.

By Kai Foo Chan
Chief Engineering Technical Specialist
FM Global – Global Services, Asia

Why is this standard so extensive? Because water-mist systems are so new and each water-mist system is so unique in its operation and design, approval is limited for now to specific occupancies and applications that have been tested by FM Approvals. For this reason, the new standard must describe fire testing for each of these occupancies and applications, as well as tests for the components that comprise these systems.

WHY WATER MIST?

Water-mist fire protection systems offer some unique benefits that make them particularly well suited for challenging environments. For instance, water-mist systems not only can suppress or extinguish fires, but they also can have a cooling effect within the protected space that makes it easier for firefighters and others to enter and extinguish the fire. Water-mist systems also use far less water than conventional sprinklers, a tremendous advantage where contaminant runoff is a concern or runoff collection is mandated. Other advantages include:

■ **Prevents re-ignition.**
Because of its cooling effect and room-flooding ability, water-mist systems are very good at preventing re-ignition, even from oil-bath fires and other pool fires.

■ **Works well in high-heat-release fires in enclosures when total "flooding" protection is used.**
As an enclosure is flooded with water mist, the atomized droplets are drawn to the base of the fire along with room air. The water mist instantly flashes to steam, expanding in volume by about 1,700 fold, replacing the oxygen necessary for combustion.

■ **Works in partially ventilated areas.**
The system is Approved with the requirement that doors to an enclosure be interlocked to close and ventilation fans be interlocked to shut-off on system discharge. However, unlike CO_2 or halon, water mist can work in areas where a door does not close properly and does not pose a health risk like some other gaseous agents.

■ **Smoke-scrubbing qualities.**
Some smoke and toxic gases are absorbed by the atomized water spray. The effectiveness cannot be quantified and if smoke removal is needed a properly designed smoke exhaust system should be installed.

Water-mist systems not only can suppress or extinguish fires, but they also can have a cooling effect within the protected space that makes it easier for firefighters and others to enter and extinguish the fire.

WATER-MIST SYSTEM CASE STUDY

At a construction cost of approximately US$1 million per engine test cell, and with 36 cells to be built in the initial development phase, a large automotive group had a lot riding on its new research facility. Fire protection for the heavily instrumented engine test cells was a key concern. With fuels and lubricants flowing through hoses to the engines at high pressure, spray and pool fires were a significant risk.

FM Global engineers reviewed the

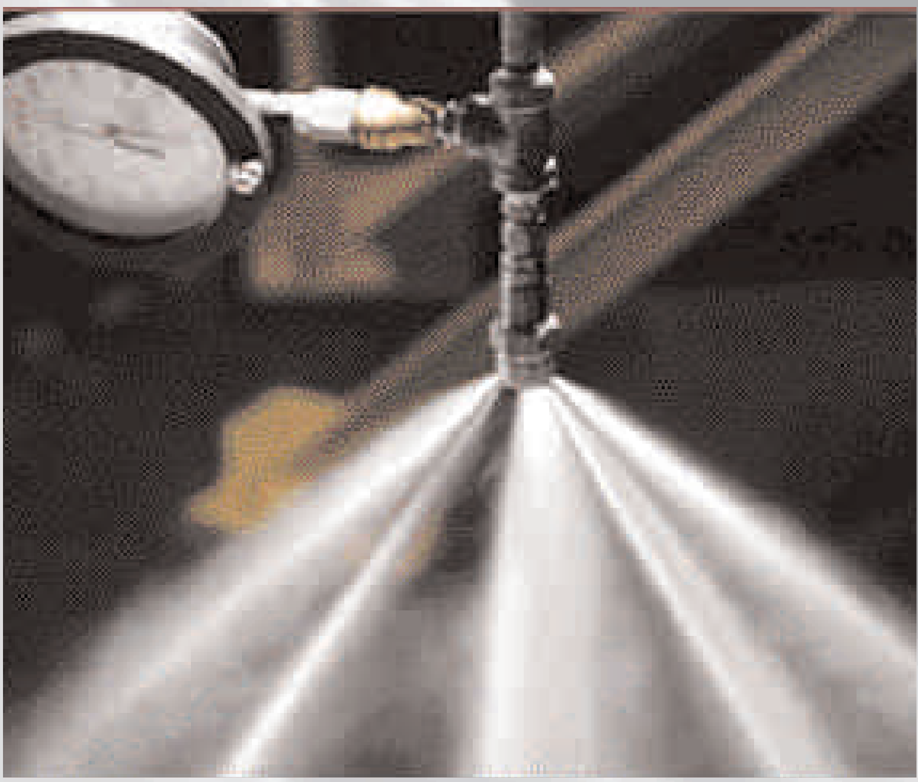
es All-Encompassing t Standard

proposed fire protection plan for the engine test cells and grew concerned that powerful ventilation and large obstructions within the cells would impede the water-mist protection system. Approved water mist systems for enclosure protection require ventilation be interlocked to shut-off when the system activates. The fire protection challenge was further complicated by a large sub-floor space housing ventilation ductwork and mechanical equipment, which had the potential to trap leaking or spilled fluids from the test cells located above the sub-floor.

To evaluate the proposed water-mist system, a full-scale mock-up of the engine test cell was built at the FM Global Research Campus in the USA. The research team developed a test programme to determine whether potential fires could be extinguished or controlled by the proposed water-mist system.

The proposed water-mist design specified that nozzles, equipped with glass bulb thermal-link triggers, should be located on the cell ceiling and inside the engine ventilation ducts. Diesel and room temperature n-heptane were used to simulate heated lubrication oil and gasoline.

Two types of detection/trigger mechanisms also were tested – UV/IR detectors and glass-bulb links. Through this evaluation, it was determined that the original layout of nozzles, located only at the ceiling and in the engine ventilation ducts, could not extinguish a 1m^2 n-heptane pool fire, partially shielded below the engine mock-up or located below the ceiling ventilation opening. (Note: Pool fires with n-heptane and diesel located in other areas of the test cell could be extinguished with the original layout of nozzles.)



A water-mist nozzle undergoes "K" factor testing to determine flow characteristics

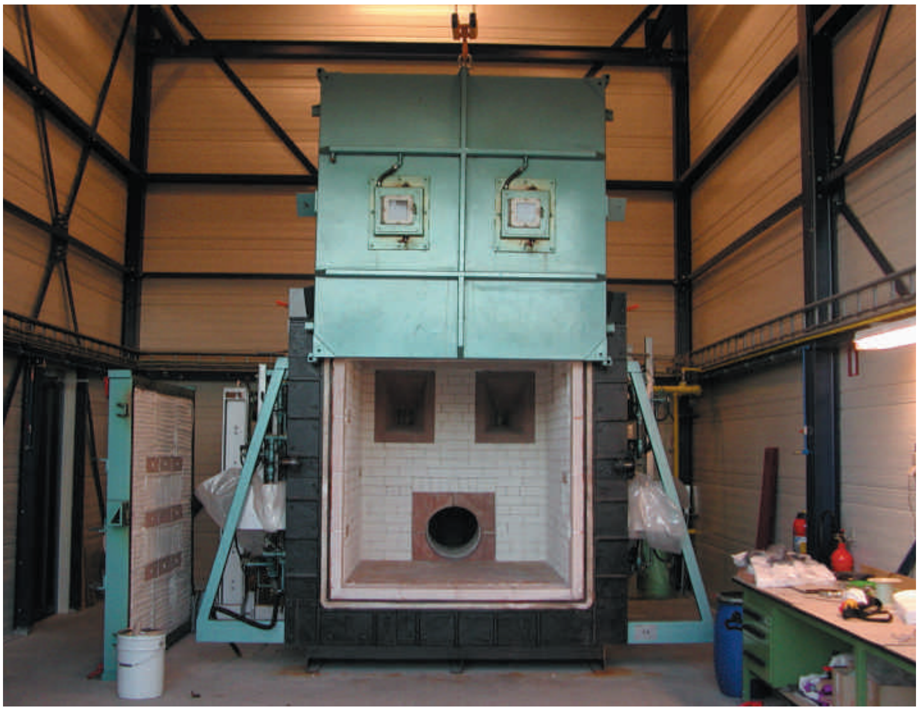
To provide adequate protection, two additional water-mist deluge nozzles were added to the sidewalls of the engine test cell, and linked to two UV/IR detectors located diagonally apart in the upper ceiling corners. Two additional ceiling nozzles also were added to address certain vulnerable areas. The original glass-bulb link nozzles located in the sub-floor area were tested and found to provide adequate protection without modification. Since the completion of this research, the company has built 36 engine test cells at its new research facility, using the FM Approvals tested water-mist protection system.

SETTING THE STANDARD

Approval Standard 5560 from FM Approvals will provide the most comprehensive single source of water-mist test requirements in the world for land-based applications. Manufacturers of water-mist systems and components will be able to quickly find fire and component test requirements. This will save both time and money by reducing errors and helping manufacturers to more accurately anticipate the test program required for approval.

Following review, the final standard will be released in late summer or early autumn. FM Approvals hope the new approval standard is adopted or used as a springboard for international water-mist standards for land based applications.

Following review, the final standard will be released in late summer or early autumn. FM Approvals hope the new approval standard is adopted or used as a springboard for international water-mist standards for land based applications.



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Ameron offers a range of intumescent coating systems for various grades of fire protection, various weathering exposure conditions and application techniques while complying with many international and national legislations and standards.

For on-site application in closed buildings Ameron International also markets a waterbased intumescent coating, Steelguard FM 580. This product can be combined with a matching waterbased primer and a waterbased finish and is used where buildings are repaired, refurbished or sometimes completely stripped and rebuild to allow a complete new usage of the construction.

Applications with Ameron's intumescent coatings

Constructions where Steelguard FM intumescent coatings are used are for example shopping centres, warehouses, stadiums and airport terminals.

Typical constructions presently under development and coated with Ameron's Steelguard FM are amongst others: Dubai International Airport, London Heathrow, Wembley National Stadium and Sofia Airport.

Large projects require additional fire engineering in which the coating supplier, designer and contractor develop solutions for specific project applications.

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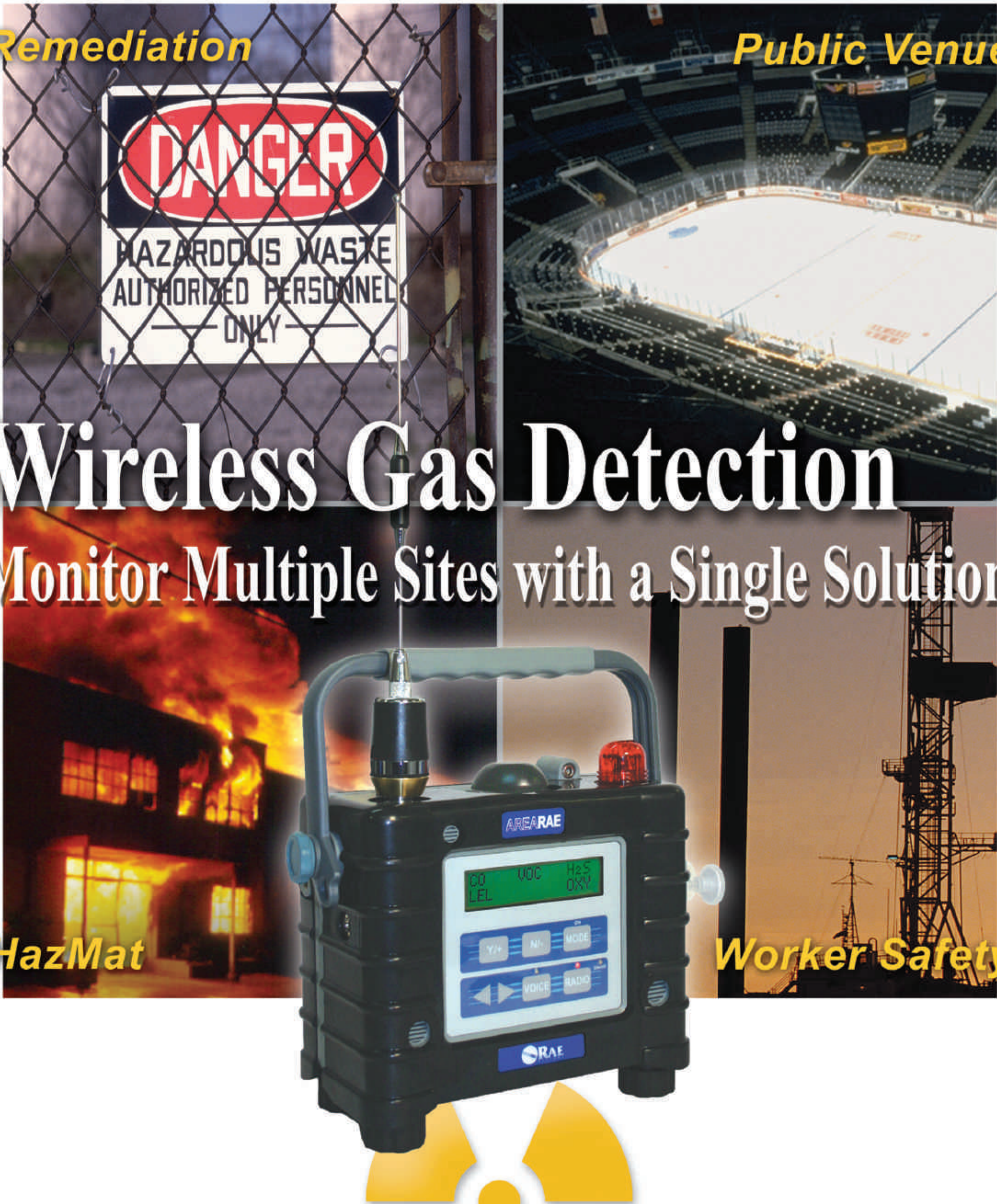

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Hazardous Environment Detection

Concrete in Fire

By Graham Ellicott, Chief Executive, Association for Specialist Fire Protection (ASFP)

Aftermath of fire in Mont Blanc tunnel, France

Passive solutions for explosive tunnel problems

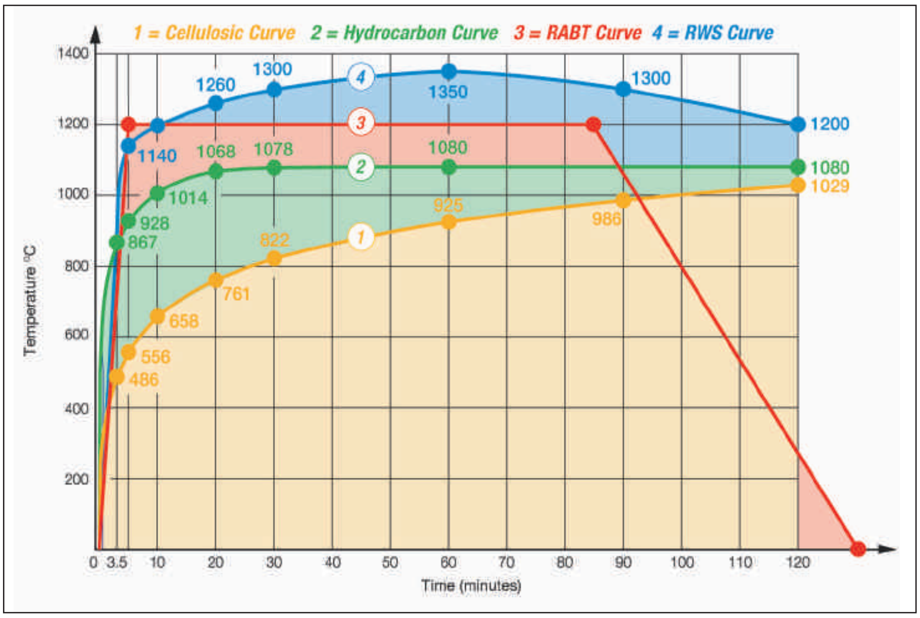
IN RECENT YEARS THERE have been a number of fires in tunnels that have led to fatalities and the casualty figures make horrendous reading. The fires and toll include: 1995 Baku Subway: 289 dead, 1999 Mont Blanc: 39 dead, 1999 Tauern: 12 dead and 2000 Kaprun: 155 dead.

A 2000 report from Deutsche Montan Technologie GmbH (DMT) looked at the safety of 25 road tunnels. It found that in comparison to normal roads and major trunk routes, the risk of accidents in road tunnels is minor. Why is this? Well, road tunnels are not affected in the main by weather and have good operational systems such as lighting, speed limits and a small incidence of junctions.

Despite this even small accidents in tunnels can prove difficult for the emergency services to manage due, in the main, to restricted access. But it's not only road tunnels that can have problems. The Swiss Bundesamt für Verkehr looked at the safety of rail tunnels and found that 110 out of 689 had safety problems. Thus, even though the incidence of accidents may be low in tunnels, any fire may prove difficult to control and this can lead to catastrophic consequences.

Many tunnels are constructed using either pre-cast concrete sections that are sunk into a trench and then covered, or by the lining of bored tunnels with concrete. There is a general perception that concrete will not burn and therefore must be fireproof. After all, at one time we used concrete to protect steel from fire so it must be so! In a fire situation, however, concrete can suffer explosive spalling, showering the tunnel occupants (be they the trapped public of fire fighting service personnel) with pieces of concrete. This spalling is caused by the residual moisture in the concrete boiling and causing high pressure steam, which in trying to escape, will cause the concrete to crack and shatter, in some cases with explosive consequences.

This problem has been found particularly in high strength concrete and as long ago as 1976 the American National Institute for Standards and Testing (NIST) initiated research into the fire performance of the material. In the Channel tunnel fire in November 1996 the firemen complained that they were showered with concrete and photographs of the railcars show their



Time/temperature curves

Aftermath of Channel Tunnel fire

roofs sagging under the weight of the spalled material.

The NIST research indicated that explosive spalling can be expected at temperatures between 300ºC and 450ºC and it is interesting to consider that steel sections, when fully loaded, lose their strength at between 550ºC and 600ºC, but do not in fact start to lose strength quite as quickly. Work on bored tunnels using concrete linings in Holland shows that explosive spalling can occur within 10/15 minutes at surface temperatures of as low as 200ºC, so it is proposed to limit surface heat to 200/250ºC in such structures. The Dutch experience claims that where the moisture content is over 3% of the mass, the risk of explosive spalling is 100%.

After much research at the TNO laboratories, the Rijkwaterstraat (The Dutch Transport Ministry) takes the view that existing tunnel structures that must be protected from fire in the "worst case" scenario. Fire tests are required on an individual project basis and the tests are done to the special heating regime known as the RWS Curve. This is more severe than the hydrocarbon curve used in the petrochemical industry and has a maximum temperature of 1350ºC maintained for up to 2 hours.

Under the standard rules the Dutch authorities require the surface temperature of the test piece to be restricted to 350ºC and the temperature at 25mm cover depth to 250ºC, which ties in quite well with the NIST experience. The imposition of this temperature limit leads to a requirement for added fire protective insulation to the concrete lining and tests of prospective materials must show no loss of bond, failure of fixing or explosive spalling.

In order to protect tunnels from the ravages of high intensity fires holistic solutions, combining active measures such as fire detection systems, management systems such as evacuation procedures and passive fire protection systems, should be employed after a detailed risk assessment has been carried out as part of the tunnel's design process.

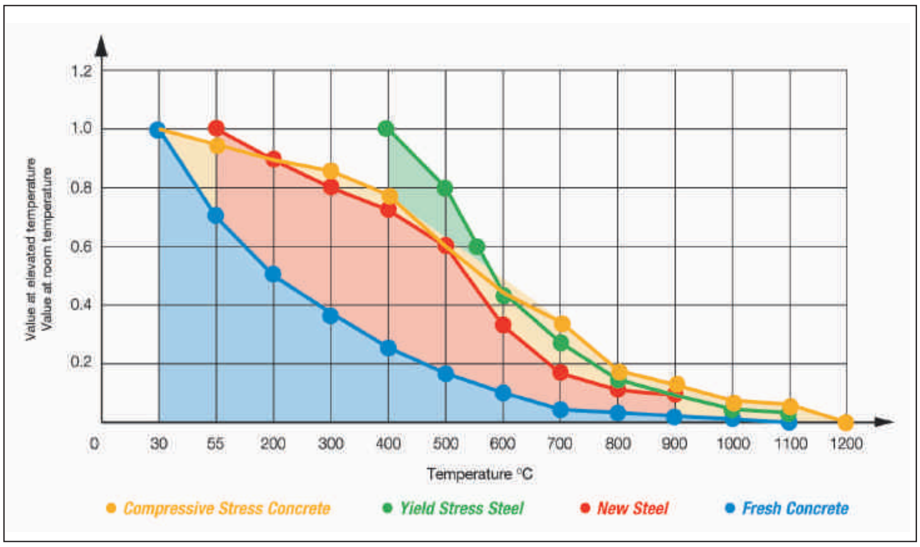
In particular, passive fire protection systems are commonly used to protect the concrete in a tunnel and these products are easy to install. In the event of a fire, these materials can result in the quick re-opening of the tunnel as they are relatively quick to replace in comparison to the reinstatement of fire damaged concrete.

Typical systems include proprietary spray applied cementitious products and autoclaved calcium silicate boards utilizing inert fillers. The mechanism for the protection of the concrete by cementitious and calcium silicate products is twofold. Firstly, they contain trapped moisture, which in a fire situation will boil and keep the concrete temperature around 100 Celsius until all the water has disappeared. Secondly the product then acts as an insulator.

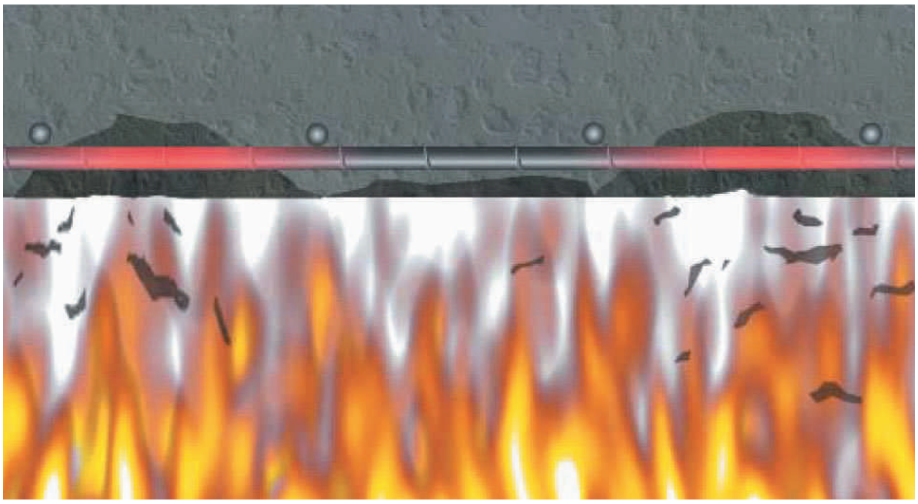
But what are the benefits of these passive fire protection materials?

Firstly, the added extra insulation that they give will mean no repairs to the concrete itself after a fire as the concrete temperatures will not have reached a high enough level. Temperatures as low as 160 Celsius can mean that repairs are needed, for example concrete containing polypropylene fibres will need reinstatement as these products will have melted. Once temperatures reach 300 Celsius, the bond between the concrete and the rebar will have significantly reduced. At 380 Celsius it is generally accepted that all concrete that has been exposed to these temperatures will need removal and subsequent repair. Even smouldering fires can dehydrate the surface of concrete and if a serious hydrocarbon fire then follows on the level of explosive spalling is likely to be even greater.

Passive fire protection products do not impinge upon the long term durability of concrete as they have no affect on the porosity of the material. Nor do



Influence of temperature on concrete



Spalling

they cause the formation of any cracks or channels that can admit harmful agents such as sulphates or chlorides that will attack the rebar.

Similarly, as proprietary passive fire protection products are placed between the concrete and the fire they have no effect on the properties of the concrete during placement, or in its lifetime. In comparison, additives to infer extra levels of fire protection to concrete can result in materials with complex mix designs that are difficult to pump or pour and that give poorer pull out strengths for anchors.

Another major benefit is that proprietary passive fire products are specifically designed, factory manufactured, tested and assessed for their end use and can be installed by companies that are members of third party accreditation systems. Such schemes are referenced in Approved Document B Fire Safety to the Building Regulations for England and Wales which states:

> *'Since the fire performance of a product, component or structure is dependent upon satisfactory site installation and maintenance, independent schemes of certification and registration of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided.'*

The use of third party accredited applicators for products will become even more important next year when the Regulatory Reform (Fire Safety) Order (RRO) is likely to become law. The RRO places the onus of the fire safety on the shoulders of the Responsible Person who is either the employer (where there is one), the person in control of the premises/structure, the owner or any other person who to any extent exercises control over the premises/structure.

Under the RRO, the Responsible Person will be required to ensure that an assessment of the risk of and from fire is undertaken for the place and activity. Identified hazards will be removed, or reduced, so far as is reasonable and special consideration will be given to the risks posed by the presence of dangerous chemicals or substances and the risks that these pose in case of fire. Special consideration will also be given to any group of persons who may be especially at risk in case of fire, whether due to their location or any other factor.

All precautions provided will be subject to maintenance and will be installed and maintained by a 'competent person'. Under the RRO, a person is to be regarded as competent where he/she has sufficient training and experience, or knowledge and other qualities to enable him/her properly to assist in undertaking the preventive and protective measures.

Thus, where concrete needs extra fire protection, the use of proprietary passive fire protection products that are installed by third party accredited contractors using competent personnel will allow the Responsible Person to demonstrate that he/she has taken reasonable measures to discharge their duties under the RRO.

In summary, the use of proprietary passive fire protection products to enhance the performance of concrete structures in fire will result in the faster re-opening of a fire damaged structure, will not affect the durability or the placement of the concrete and will allow those responsible for the fire safety of the structure to sleep more soundly at night.

S.A.C.E.P.

BUREAU VERITAS
NOTIFIED BODY 1370

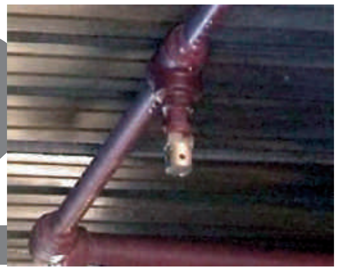
TECHNOLOGY AND SAFETY - COMPLETELY HFC

The fire-extinguishing agent **SACLON 2 ECO** is a mixture of colourless gases, that were skilfully mixed with a detossifying agent with scent of pine. The tanks are provided with rapid flux valves and the turned brass discharge nozzles are opportunely gauged for a rapid gas efflux in order to obtain the total discharge of the fire-extinguishing agent in a maximum time of 8/10 seconds. The action on fire of **SACLON 2 ECO** is to reduce in few seconds the oxigen percentage under the 14%, threshold under which fire can not survive. Thanks to its specific features it does not damage bronzes, plaster casts, pictures, clothes, tapestries and works of art, as it has no colour, no smell and it is not corrosive.
Thank to its composition, **SACLON 2 ECO** does not belong to the substances forbidden by the law nr. 549/93 and by the CEE REGULATION 3952/92, so it is actually a product considered "clean" and without limits of use or expiry. The use of the detossifying agent and the reduced discharge time lead to a rapid reduction of the environmental oxigen, with the guarantee of very rapid extinction time and restricting the damages caused by the fire they give rise to a sinergistic effect, with a reduced formation of decomposition products caused by high temperatures and allowing the evacuation of personnel in the area.

1

The pyre in pinewood, made in accordance to the UNI 10877 regulation, after being set on fire for three minutes and being let burning for three more minutes, is brought into the test-room in which there are the instruments for the survey of the data related to temperature and the percentage of oxigen in the various heights.

2



High pressure brass nozzles, appropriately gauged, guarantee the saturation of the environment in the maximum time of about 8/10 seconds.

3

The area is rapidly becoming saturated with **SACLON 2 ECO** and the fire on the wooden pyre is stiffling because of the reduction of oxigen.

4

The extinction took place and in the area the combustion's smokes and the extinguishing agent's rests are now circulating. The area should be abundantly aired.

5

When the door opens you can see cleary the wooden pyre completely extinguished and without embers from the combustion.

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S.A.C.E.P.

SACLON 2 ECO AUTOMATIC FIRE FIGHTING SYSTEMS

The product **SACLON 2 ECO** is a mixture obtained by chemical products absolutely ecological and not corrosive, that obtained the homologation of the **Italian Ministry of the Interior** and the preventive approval of the **Ministry of the Environment** and the **Health Institution**, whose documentation is in the archives in the **Ministry of the Interior**.
SACLON 2 ECO, for its own composition, does not have any limit of expiry or use, it does not harm the hozone and it does not belong to the range of products whose utilization is forbidden for the hozone, as it has

ODP=0 **GWP=0,26** **ALT=16**

The product belongs to the fire-extinguishing agents included in the **E.P.A. REGULATIONS** (United States Environmental Protection Agency) and **NFPA 2001**, and thanks to its particular features it is suitable for the use for portable fire-extinguishers and in trolley fire-extinguishers.
The product passed brilliantly the test by the laboratory recognized by the **Italian Ministry of the Interior** as a total flooding fire-extinguishing agent to use in fixed automatical extinguishing systems, in accordance to the **REGULATION UNI 10877/1 "GAS FIRE-EXTINGUISHING SYSTEMS"**.
The great results obtained by the product during the test, as rapidity in the reduction of the oxigen level that leads to rapidity in the extinction, both for A class (fires from solid material) and for B class (fires from liquid material), make it become a first quality fire-extinguishing agent. The certification in accordance to the **EUROPEAN STANDARD UNI 10877/1**, that adds to the american one previously in force **NFPA 2001**, shows that the product is particularly suitable for the use in fixed fire-extinguishing systems of small, medium and big dimensions, in areas normally occupied by personnel, with the eventual limitations expected for the substitutes of Halon as total flooding agents, in centres for the elaboration of data and on apparatus under tension.

SAFETY

MAXIMUM TIME 8/10 SECONDS

ECOLOGY

NOT CORROSIVE

REGULATION UNI 10877/1

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Assessing the fi of external cla

System under test on BRE External Cladding Test Facility

The Issue

Fires involving multi-storey buildings are fortunately rare but their consequences can be significant. Losses from commercial incidents such as the Basingstoke fire in 1991, in which two floors of a 14-storey office block were damaged resulted in a £15.6M claim. The Garnock Court fire in Irvine, Scotland in 1999 gave rise to a Parliamentary inquiry into the potential risk of fire spread in buildings via external cladding. One of the recommendations from the inquiry included the statement that "we do not believe it should take a serious fire in which people are killed before all reasonable steps are taken towards minimising the risks."

By Sarah Colwell

External Fire Spread

Following the initiation of a fire inside the building, if no intervention occurs, the fire may develop to flashover and break out from the room of origin via a window opening or doorway. Flames breaking out of a building from a post flashover fire will typically extend 2m above the top of the opening irrespective of the material used to construct the outer face of the building envelope, Figure 1.

BS 8414: Part 1: 2002

BS 8414: Part 1: 2002, based on BRE Fire Note 9, is a full-scale test designed to investigate the fire performance of non-loadbearing exterior wall assemblies, including external wall insulation systems and curtain walling, fitted to a masonry substrate when exposed to an external fire source at a realistic scale.

A 9.6m high test facility is used with a main face 2.8m wide and includes a right angle internal return wall, a minimum of 1.5m deep, (Figure 2). The fire source is designed to represent a fire exiting from an opening such as a window in a post flashover room. The duration of the fire source is 30 minutes.

Thermocouples are located at the mid-depth of each combustible layer and cavity where present. The thermocouples are located at two heights above the fire source; 2.5m and 5m and the time taken for the fire to spread between these two levels is determined for each layer and cavity in the system. Any system collapse or delamination is also noted. The test method does not assess the fire resistance of the exterior wall assembly or the fire performance of the test specimen when a fire migrates through the external compartment wall attaching the rear face of the system.

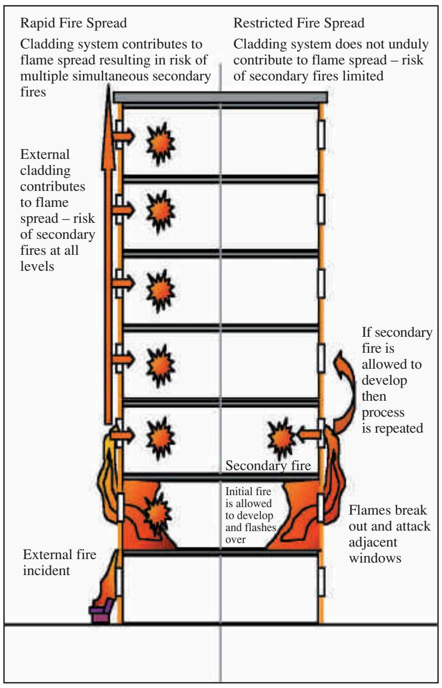


Figure 1. Principle behind BS 8414 series and BR 135

BR135 – Fire Performance of External Thermal Insulation for Walls of Multi-Storey Buildings. Second Edition

In 2003, the second edition of the BRE Report 'BR135 – Performance of External Thermal Insulation for Walls of Multi-Storey Buildings' was published. It provided updated guidance on the fire performance of external cladding systems and a classification system for the BS 8414 part 1: 2002 test method. The criteria used to assess these systems is based on the time taken for the fire to spread upwards through each layer of material used to make up the system, including the internal and external faces and cavities, if present.

Draft BS8414: Part 2

The changing needs of the construction industry and developments in building techniques gave rise to the development of a second part of the standard. This part of the standard has been developed to provide a test method for assessing the fire performance of non-loadbearing external cladding systems supported by a building frame, such as curtain walling, glazed units, infill panels and insulated composite panels at full-scale when applied to the face of a building and exposed to an external fire under controlled conditions. This standard is due to be published over the summer.

As with part 1 of the test method, a classification system for this part of the test standard will be included as an annex to the BR135 document.

re performance dding systems

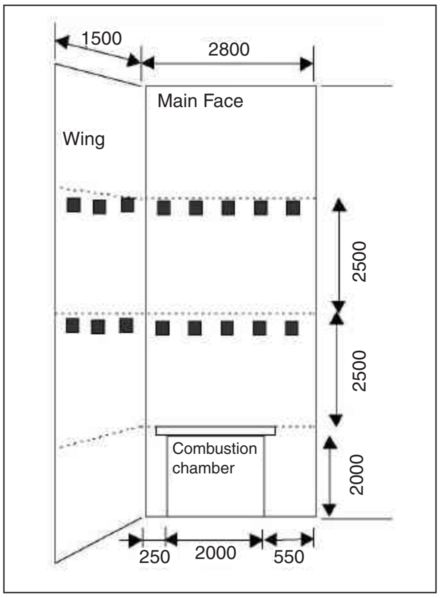


Figure 2. Test facility

Guidance for current Building Regulations in England and Wales

Where the guidance provided in the 2000 edition of Approved Document B (AD B) (Fire Safety) to the Building Regulations 1991 cannot be met for the fire performance of external cladding system, an alternative method such as BRE Fire Note 9 can be used to demonstrate that the risks of spread of fire over external walls have been minimised. This test method does not assess the fire resistance of the systems nor does it address the provisions for fire spread between buildings. BR135 Second Edition and BS 8414-1:2002 have superseded BRE Fire Note 9.

Technical Approval

As part of the Construction Products Directive (CPD), an ETAG (Guidance for European Technical Approval), ETAG 004 for External Thermal Insulation Composite Systems with Rendering was published in 2000 to provide a route for CE marking of these products. As part of this ETAG, the reference to fire performance includes the provision for the use of full-scale testing to evaluate the performance of fire barriers for insulated systems, if required.

Certification

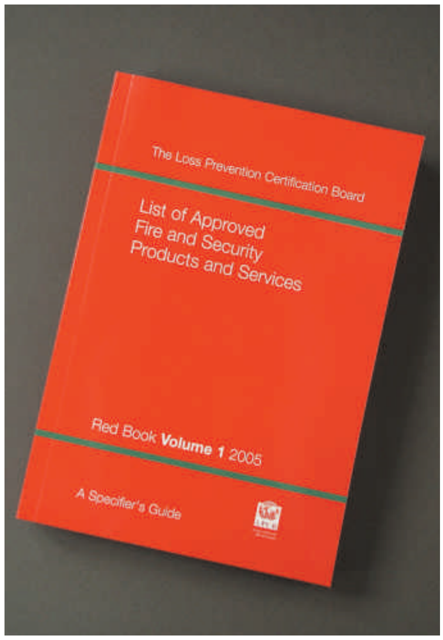
One method of ensuring that the product meets the standard is to choose one that is certificated by a nationally accredited certification body. Certification by LPCB is independent third party confirmation that the product meets and continues to meet the appropriate standard. The certification process involves rigorous assessment and testing of products and services to ensure that they meet and continue to meet quality standards set by a team of experts which include manufacturers, installers, designers, clients, regulators, insurers, engineers and scientists.

In order to meet the demands from the market for certification schemes to cover the fire performance of composite systems, a new LPCB scheme has been launched as part of the LPS 1181 series of fire growth tests for LPCB approval of construction product systems. LPS1181 part 4 covers systems tested under BS8414-1:2002 with a part 5 scheme to be available to cover BS 8414-2 systems once the standard is published.

There are many approval bodies including many with their own strong brands, not all of them, however, have their own on-site testing facilities and expertise. LPCB, together with its predecessor the Fire Offices' Committee (FOC) has been involved for over 150 years in working with specifiers including clients, insurers, and regulators to set national and international standards.

Listing

Once a product, service or company meets the required standard, a certificate is issued in the relevant 'Red Book', either the List of Approved Fire and Security Products and Services or List of Approved Companies and Construction Products. Listing in the Red Book is a very useful marketing tool for the approved companies as thousands of specifiers and insurers around the world use the Red Book to select their suppliers. The Red Books are published in January each year and on CD ROM in January and June of each year. These publications are mailed out to a database throughout the world including insurers, clients, architects, surveyors, engineers, etc., and many thousands of copies are handed out at exhibitions, seminars and presentations. A "live" fully-searchable copy of the Red Book is continually updated online at www.redbooklive.com.



Sarah Colwell is a business group manager with BRE Testing with responsibility for the Passive Fire business area. She has twenty years experience of fire and explosion testing. Sarah has a particular interest in the development of the new European fire tests together with the reaction to fire performance of building envelopes including cladding and roofing systems. As well as producing a guidance document in this area she is also member of several British Standards and CEN committees working on these topics.

TYCO FIRE & BUILDING PRODUCTS

K240 (K17-231) Sprinkler Performance in Warehouse Fire Tests

Tyco Fire & Building Products in cooperation with Factory Mutual, Underwriters Laboratory and several other enterprises embarked upon a rigorous series of tests, designed to test the performance of the K240 sprinklers in specific and challenging warehouse applications.

Overall Performance of the K17-231 vs. Standard Spray Sprinklers

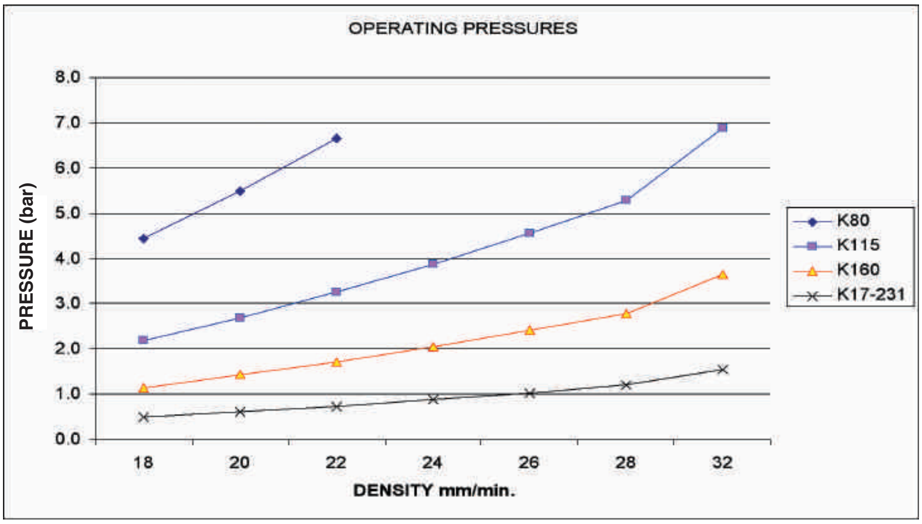
Background. The initial series of tests was conducted to evaluate the overall performance of the K17-231 with that of standard spray sprinklers. Tyco Fire Products wanted to evaluate the performance characteristics of the K17-231 sprinklers against those of Standard Spray Sprinklers at identical ceiling densities. These densities are part of the Density/Area design method prescribed for Spray Sprinklers by both Factory Mutual Installation Standards and the National Fire Protection Association's (NFPA) 13, 231, 231C, 231D, 231E, 231F and associated installation Standards.

This was considered groundbreaking research for this new K-factor, since no data was available regarding the performance of any sprinkler at such low operating pressures in providing control of fires of 18mm/minute or greater.

The Test. The series of tests performed on the K240 was the same series of tests performed in the 1970's on the earlier K-factor models. The K240 was subjected to the same density curves as were the K1150 and K115 orifice sprinklers that were tested two decades earlier.

Table 1 shows the operating pressures required for the K17-231 and earlier standard sprinklers.

Table I – Discharge Pressure Comparison



Concern about the low operating pressure focused the product development on the operating pattern, discharge velocity and droplet size. The fire challenge of these densities provide a strong fire plume under the sprinklers, making it difficult to provide water droplet penetration of the plume to reach adjacent combustibles and provide control of fire spread. Measurements during and after full-scale fire tests were taken to show the number of operating sprinklers (temperature control) and the extent of damage to the fuel array (pallet loads consumed).

Tables II and III show the comparative performance of standard spray sprinklers with the K17-231 sprinklers.

Many other measurements were taken during the testing, gas and steel temperatures were monitored and found to be within acceptable limits and well below that of standard K1150 and K115 sprinklers.

The Results. The K17-231 sprinkler performance was significantly better than expected. The K17-231 proved that it would provide protection following the published area density methods of design.

Specifically, the discharge pressure required for the K17-231 sprinkler was a full 78 % less than the pressure required for a K115 sprinkler and represented an 89% reduction compared to a K1150 sprinkler.

Additionally, the number of sprinklers opened during the 18 mm/minute tests of the K17-231 provided a 83% reduction from the number of opened standard K1150 sprinklers and provided an 88% reduction in fire damage.

Similarly, the number of sprinklers opened during the 24 mm/minute tests provided a 76% reduction from the number of opened Standard K115 sprinklers and an 84% reduction in fire damage.

Conclusions. In summary, the K240 was proven to perform better than earlier standard sprinklers from two significant perspectives:

- The K240 required less discharge pressure
- Fewer sprinklers needed to activate to provide the same level of protection during both the 18 mm/minute and 24 mm/minute fire tests.

Table II – Full-Scale Fire Tests Using 18 mm/minute density

Comparison I: FMRC Plastic Commodity, 2,7-m High Rack Storage, 9,1-m High Building			
Protection: 18 mm/minute Discharge Density		Fire Test Results	
Sprinkler Model (K-Factor)*	Discharge Pressure (bar)	Sprinklers Opened	Pallet Loads Consumed
Standard K1150	4,62	29	14
K17-231™ Upright (K240)	0,5	5	2

Table III – Full-Scale Fire Tests Using 24 mm/minute density

Comparison I: FMRC Plastic Commodity, 4,2-m High Rack Storage, 7,6-m High Building			
Protection: 24 mm/minuteDischarge Density		Fire Test Results	
Sprinkler Model (K-Factor)*	Discharge Pressure (bar)	Sprinklers Opened	Pallet Loads Consumed
Standard K1150	3,86	29	25
K17-231™ Upright (K240)	0,86	7	4

For more information please contact:

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DESIGN SAVINGS:

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- MINIMUM SYSTEM DESIGN SAVINGS IS:
  - 216+ GPM (817 + L/MIN) FOR cULus
  - 240+ GPM (908 + L/MIN) FOR FM APPROVAL

BEATS THE K-25!

SINGLE SPRINKLER PRESSURE & FLOW REQUIREMENTS:

Approval	Bldg. Height*	K-25 Pressure	K-25 Flow	K-22 Pressure	K-22 Flow	K-22 System Savings
cULus	45' (13,7m)	40psi (2,8 bar)	160 gpm (605 L/min)	40 psi (2,8 bar)	142 gpm (537 L/min)	216+ GPM (817+ L/min)
FM/VdS**	45' (13,7m)	50psi (3,4 bar)	178 gpm (673 L/min)	50psi (3,4 bar)	158 gpm (597 L/min)	240+ GPM (908+ L/min)

* with up to 40ft. (12.2m) storage
** VdS approval is for K-22 only

- ELIMINATE IN-RACK SPRINKLERS FOR 45'(13,7M)HIGH BUILDINGS.
- LOWER FLOWS OFFER OPPORTUNITIES TO REDUCE:
  - INTERIOR PIPING
  - UNDERGROUND PIPE
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New Approval Standard for Steel Pipe

By Charlie Mahall

Critical Fire Protection Component Gets New Attention

SINCE THE FIRST COMMERCIAL fire protection sprinklers were installed more than 100 years ago, steel or iron pipe has been the predominant means to carry water throughout sprinkler systems. Early sprinkler pipes were extremely heavy and thick compared with today's standard Schedules 10 and 40 pipe, and especially newer "specialty" pipes known as thinwall or lightwall. Pipes installed in the early 1900s, in many cases, are still certified for use today, having lost only a fraction of their original wall thickness due to corrosion.

The past few years alone have led to many changes in the production and use of steel pipe for fire protection systems. Factors including increased cost of raw material, rising fuel cost, the growth in international steel production, lower-cost import competition and fluctuations in demand have resulted in sprinkler-pipe alternatives that provide design flexibility and reduced cost, but not the longevity of yesterday's heavy pipe.

While standards and specifications for pipe production abound, only those administered by third-party agencies or laboratories include active monitoring of both manufacturing and quality control. Domestic and international manufacturers may claim they adhere to standards set forth by the American Society of Mechanical Engineers (ASME), American National Standards Institute (ANSI), International Standards Organization (ISO), or the American Society for Testing Materials (ASTM), but actual dimensions and material properties may vary substantially. Only through rigorous evaluation, inspections and audits by a third-party agency can a buyer be reasonably assured of receiving the quality, performance characteristics and dimensions expected.

"Until 20 years ago, we didn't Approve sprinkler pipe because we were never asked to," said Charlie Mahall, senior engineer, FM Approvals' hydraulics group. "Prior to that time, Schedules 10 and 40 pipe were the standard. Then, imported pipe became a factor in the sprinkler-pipe market. This pipe was being produced by manufacturers we didn't know, stamped with standards ratings we didn't always trust. At about the same time, the introduction of thinwall and lightwall pipes that dipped below Schedule 10 sizes got our attention as well."

According to Mahall, FM Approvals began evaluating and Approving steel sprinkler pipe using draft standards in response to requests from clients and from domestic pipe makers who sought a way to differentiate their products in an increasingly competitive market. "There are no regulatory agencies or other third parties checking many of

New Approval Standard for Steel Pipe

these overseas manufacturers," he explained. "Here was a sprinkler system component – pipe – that comprises more than half the material and half the cost of the fire protection system, yet it was being treated as a simple commodity. Manufacturing high-quality steel pipe is a complex and exacting process, and there are differences among products from different makers."

While FM Approvals has been evaluating and Approving steel pipe for use in fire prevention systems, there has not been a comprehensive Approval Standard that addressed the many types of steel pipe available today. About a year ago, Mahall and others began developing Approval Standard 1630, Steel Pipe for Automatic Fire Sprinkler Systems. The new Approval Standard was reviewed by manufacturers, industry experts and clients and issued by FM Approvals last fall.

"Approval Standard 1630 offers manufacturers, clients and code officials a place to find test requirements and other criteria for testing different types of pipe, be it Schedule 10, 40, thinwall, lightwall – you name it," said Stan Ziobro, FM Approvals' technical team manager, hydraulics group. "This is a win-win for everyone. Manufacturers win because they now have a clear standard for product Approval and an additional means to differentiate their products. Building owners win through greater choice in FM Approved products, and the assurance that FM Approved products have been extensively evaluated, including visits to manufacturing sites for quality verification."

Producing Approval Standard 1630 was not without pain or controversy, noted Mahall. "We required fairly heavy galvanized coatings for the galvanized pipe we Approve," said Mahall. "That's a costly process for manufacturers; however, it results in much longer life for galvanized sprinkler pipes required by FM Approvals in dry sprinkler systems. There was quite a lot of discussion at numerous points in the Approval Standard's development, but we believe we have produced a fair and balanced Approval Standard that will help the industry in many ways."

Approval Standard 1630 provides requirements and test protocols for pipe performance, dimensions, manufacturing quality and installation inspections. Among the performance tests required are:

- **Hydrostatic strength:** pipes must be able to withstand an internal hydrostatic pressure equal to four times the rated working pressure without cracking, rupture or permanent distortion.
- **Bending moment resistance:** for each joining method, pipes must demonstrate bending moment resistance, without leakage or fracture.
- **Rotational bending moment resistance:** when pipe is used with mechanical fittings.
- **Vibration:** for all FM Approved joining methods.

N-252 from Reliable Sprinkler

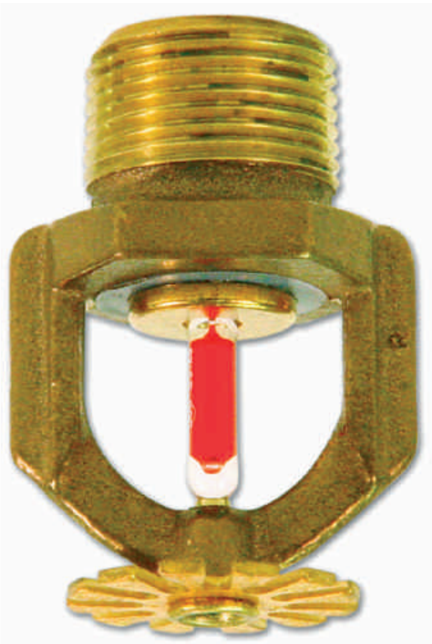
J-168 Upright from Reliable Sprinkler

- **Marking durability:** pipe markings must remain legible under conditions of storage, transport and handling to allow identification of the product.
- **Corrosion-resistant coatings:** corrosion-resistant coatings, such as hot-dip galvanizing, must have an average coating thickness of 1.8 oz./ft^2 (0.55 kg/m^2) on each sample, regardless of the standard to which the pipe was made, for use in dry sprinkler systems.
- **Long-term corrosion testing:** for threadable thinwall pipe Approval, sample pipes from 14 different lots of steel will be subjected to a 200-week corrosion test to determine if the pipe exhibits corrosion rates in excess of the established rates for Schedules 10 and 40.

Merle Farrington, engineer, FM Approvals' hydraulics group, oversees the long-term corrosion testing. "We are currently testing approximately 200 sample pipe sections," he said. "We flush the pipes, then refill and re-pressurize them once a week. We want to simulate and accelerate the corrosion these pipes might experience in actual installations. This current batch has been undergoing testing for about two-and-a-half years and we have not had a single leak or pipe failure."

The newly issued Approval Standard also details the manufacturing operations requirements that must be fulfilled. These include the demonstration of an active quality assurance program, including quality assurance guidelines, testing, inspections, calibration, drawing and procedure change control, traceability and handling. Manufacturers must submit to an initial facilities and procedures audit (F&PA) by FM Approvals engineers, as well as periodic unannounced audits.

Wheatland Tube Co., headquartered in Collingwood, N.J., USA, a maker of electric resistance welded steel pipe, was among the first to have products FM Approved under Approval Standard 1630. The company's FM Approved pipe products include Schedule 40, 10, 5, thinwall and lightwall.

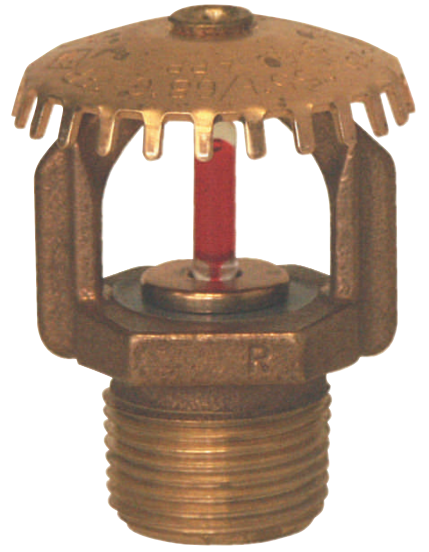


Pic courtesy of Tyco Fire & Building Products

According to Jack Gruber, Wheatland's director of technical services, the company welcomes the new Approval Standard for steel pipe. "Approval Standard 1630 gives everyone the same target to shoot for," he observed. "It helps generate a level playing field for all producers. If you're not FM Approved, then buyers or specifiers have no idea what they are getting or how a product is actually produced. This standard gives you assurance of a high level of quality and consistency. The downside of not choosing an FM Approved product can be substantial, including substandard products that can result in system failure, property damage and business interruption. Why would you not choose an FM Approved product?"

At Allied Tube and Conduit Corp., based in Harvey, Ill., USA, one of the world's largest producers of steel sprinkler pipe, Bob Bussiere, general manager of sprinkler sales and service, views the new Approval Standard as an added reinforcement that keeps manufacturers on their toes. "You never know when FM Approvals engineers may be walking in your door," he said. "The result is the best possible product for customers. It's important to our business to have our products FM Approved. Probably 80 percent of the requests for proposals we get stipulate Approval is required for the bid. The customer wants it, and we want it."

One area where FM Approvals hopes its new Approval Standard will have an impact is among foreign pipe suppliers. According to preliminary government figures, imports of standard pipe – the



Pic courtesy of Tyco Fire & Building Products

type most commonly used in sprinkler systems – were up 31 percent in 2004. High prices for scrap steel and other materials used to make steel, as well as huge demands for steel outside the United States – particularly in China, the world's largest steel producer and consumer – have led to tight supplies and higher prices for steel and steel pipe.

As a result, imported standard steel pipe is often priced below domestically produced pipe. Very little of this imported pipe, however, is FM Approved. "Foreign pipe makers are a clear target for us," said Mahall. "We want FM Global clients, all building owners and system specifiers to have the widest choice possible in FM Approved products worldwide.

We currently work with the majority of the better domestic manufacturers of steel sprinkler pipe, and look forward to providing the same service to international manufacturers for their respective markets. We have worked hard to incorporate metric conversions and international standards into Approval Standard 1630. Through our field offices and interlaboratory agreements, we stand ready to assist any pipe producer who wishes to submit products for evaluation and Approval."

High prices for scrap steel and other materials used to make steel, as well as huge demands for steel outside the United States – particularly in China, the world's largest steel producer and consumer – have led to tight supplies and higher prices for steel and steel pipe.

To learn more, contact Charlie Mahall, senior engineer, FM Approvals' hydraulics group, at +1 (1)(401) 567 0590, ext. 5442 or send an e-mail to charles.mahall@fmglobal.com

No More Broken
Forward In Call

By Ges Wallace,
Managing Director,
STI (Europe)

STI's innovative 'ReSet' manual call point mimics the feel of breaking glass whilst offering the user the benefits and environmental advantages of a resettable operating element

BREAK GLASS CALL POINTS have provided the means to manually activate a fire alarm system for decades. In the early days, a simple switch worded Fire Brigade was presented as the means to generate an alarm. Unfortunately this did not offer any deterrence from misuse, and false alarms generated by malicious or curious use were common place.

Manufacturers moved to combat this by placing the switch inside a red box. This helped reduce the incidents of false alarms generated by curiosity, but it wasn't until glass was introduced that the incidents of malicious false alarms became manageable. Glass offers a real deterrence to the casual misuse of an emergency switch and break glass call points are now widely used for a variety of emergency switching applications and not just for fire alarms.

THE PROBLEM WITH GLASS

Unfortunately the use of glass as a feature in early break glass call points introduced a number of drawbacks. The design of many of these early devices had the switch held in the operated position, usually in the centre of the glass. The switch subsequently put the glass under stress and as many break glasses were often installed next to large slamming exit doors, the result was false alarms generated by the glasses breaking without operation. The switch also ejected the broken glass out of the call point and onto the floor presenting another hazard. The glass in these types of early devices was unprotected and there was a theory that call points were produced red to hide the blood from lacerations caused during their operation.

In 1972 the Kidderminster Alarm Company introduced a revolution in call point technology by introducing the first KAC break glass call point, the main features of which addressed the issues above. The patented design moved the switch of the call point to the edge of the glass. The glass was also scored and fitted with a clear plastic protective film. While the glass was still used for its very important deterrent features, it no longer presented a hazard to the user.

This simple approach to the problem provided KAC with a truly unique concept that helped create and form the then UK standard for call points, BS5839 Part 2, and even now more than 30 years on, this approach to call point design is still adopted.

Although this approach has been tremendously successful there are still drawbacks with the use of glass as an operating element. After operation the glass is discarded and a replacement is required. On many occasions I have seen call points in the field with other objects inserted into them to maintain operation after the glass is broken – with obvious consequences.

Glass offers a real deterrence to the casual misuse of an emergency switch and break glass call points are now widely used for a variety of emergency switching applications and not just for fire alarms.

Glass, The Way
Point Technology

Traditional break glass call points could be reset in unusual ways!

Operationally the break glass concept is excellent. Glass offers natural deterrence from misuse. While working with KAC for many years I attended trade shows where we encouraged visitors to come onto the stand and "break a glass". The immediate reaction from most people was an instant refusal. When questioned, the reasons largely evolved around not wanting to destroy the product or a fear of being injured by its operation, with some visitors removing shoes or using other objects to activate the alarm.

MAINTAINING THE DETERRENCE

The challenge therefore to manufacturers is to emulate the operational and psychological characteristics of glass with an integral operating element that could be reused. This would eliminate the potential risk of inserting the wrong glass in the wrong call point or, worse still, using something other than glass to get the call point and fire alarm system operational again. Several resettable call points are now on the market, largely driven by demands from users to reduce maintenance costs and improve the overall safety of the system.

There is another major advantage of using resettable call point devices. By eliminating the need for replacement parts after every operation, the call point can be put back into working order and the system reset very quickly, reducing downtime to a minimum. Resettable call points were adopted by the London Underground some years ago for this very reason.

BS5839 Part 2, the UK standard for call points, was replaced in September 2003 with a new European standard, EN54 Part 11, which permits the use of resettable call points. This new standard, together with demand from the marketplace for a more user and environmentally friendly product will, in my view, see the end of the use of glass in call points.

One other change in the standard concerns how the operating instructions are presented on the call point. Originally these were white lettering against a black background, which was easily achieved by applying a clear label onto the glass which was printed with the operating instructions in white. The glass was then fitted into a black moulding and the necessary white on black instruction was visible, but the operating element still retained its glass appearance. EN54 has reversed this requirement and the operating instruction must now appear black on white. For resettable call points this could be achieved by moulding the operating element in a white material and printing the instructions in black onto its face. However the important operational deterrent properties of glass will have been lost, and this could lead to an increase in false alarms over time.

One innovative solution to this problem is the new STI 'ReSet' call point. Its operating element is moulded in a clear material, overprinted with the required black legend, and assembled against a white moulding. The plastic operating element takes on the appearance of glass thus retaining its deterrence from misuse. The patented operating element provides real action on operation and simulates break glass activation. An activation indicator drops into view at the top of the window after the 'ReSet' has been operated. The unit is then simply reset with a key and is ready for reuse straight away.

This unique approach eliminates glass and encompasses all the benefits of a resettable operating element. Downtime

'ReSet' call point: An indicator flag drops into view to confirm activation. The call point can then be simply reset with a key

London Underground fitted resettable call points to ensure system downtime was minimised following accidental or malicious call point activation

of the fire alarm system is minimised as the call point can be quickly and simply reset in the event of a false activation. It is very important that we retain the appearance of the use of glass in call points to prevent the possible trend towards a simple push button worded 'Fire Alarm' with the obvious consequences for false alarms.

INSTALLER BENEFITS

The benefits of resettable call points are not just limited to the user; they also offer significant advantages for the installer. The units are virtually maintenance free, with the operating element being easily reset after activation – no glass elements to break, lose or incorrectly fit during installation. Stocking requirement is reduced and there is no possibility of fitting the wrong manufacturer's glass element! Unlike traditional break glass units, which use a key for testing, call points like the 'ReSet' provide a complete functional test with every activation.

Call points are often delivered to site well before the building is commissioned and secure. This results in many of the call points having broken glasses prior to the fire alarm system being fully operational. In order to combat this waste and inconvenience, some call point manufacturers offer call points fitted with a piece of plastic to substitute the glass. While this enables installation, testing and commissioning they do render the call point inoperable. Call point glasses are then delivered to site for fitting at a later date. Unfortunately this practice, while effective in reducing break glass wastage, is dangerous. Call points will often be left with the glass substitute in place after commissioning, rendering the call point inoperable. There is also the danger that the glass substitutes will be retained by the installer or end user and used as a quick-fix when glasses are broken and no replacements are available. All these problems are avoided by using a resettable call point.

> *It is very important that we retain the appearance of the use of glass in call points to prevent the possible trend towards a simple push button worded 'Fire Alarm' with the obvious consequences for false alarms.*

STI's STOPPER is a protective cover that helps stop malicious or accidental false fire alarms from call points

EXTRA PROTECTION

The use of protective covers on call points, although previously not permitted by BS5839 Part 2, has been accepted in certain situations for more than 15 years in the UK. EN54 Part 11 now recognises this and permits the use of covers to protect against accidental operation. Protective covers also perform a crucial deterrence in many difficult areas, for example a school. The cover makes the operation of the call point a much more deliberate act and the operator is forced to linger at the call point in order to operate it. This has proved invaluable in many areas where false alarms were previously common place.

Protective covers can be integral to the call point itself or be a separate product that can be retrofitted to existing call point installations. To add even further deterrence against malicious activation, the covers can be fitted with a sounder that emits an ear-piercing alarm if the cover is lifted.

Ges Wallace is Managing Director of STI (Europe). STI markets a range of products throughout the world to prevent false fire alarms and the theft and vandalism of devices such as smoke detectors and fire extinguishers. To find out more about STI visit www.sti-europe.com.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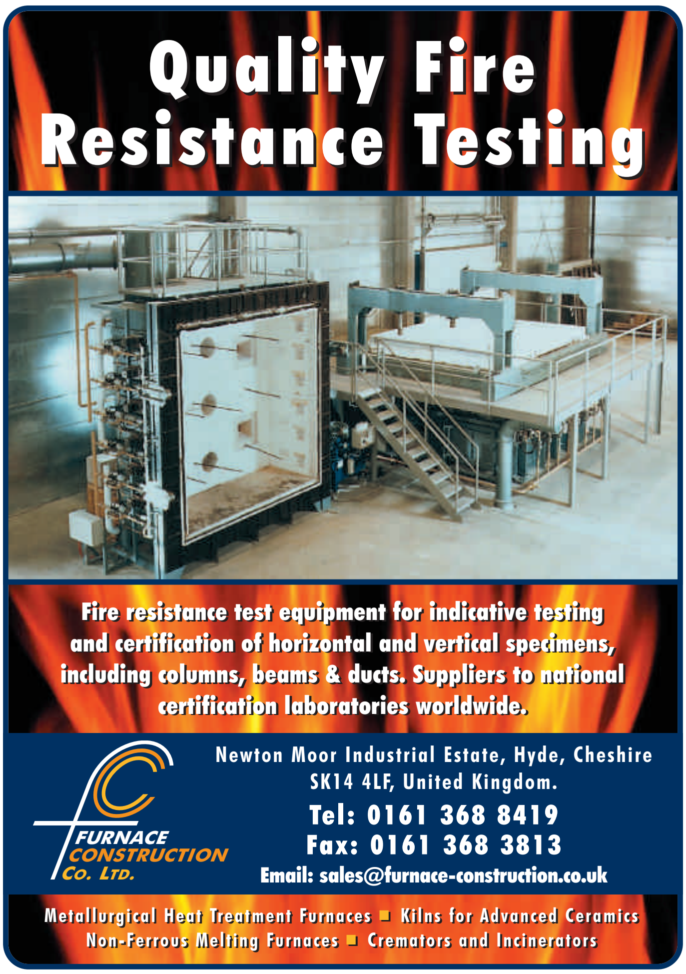
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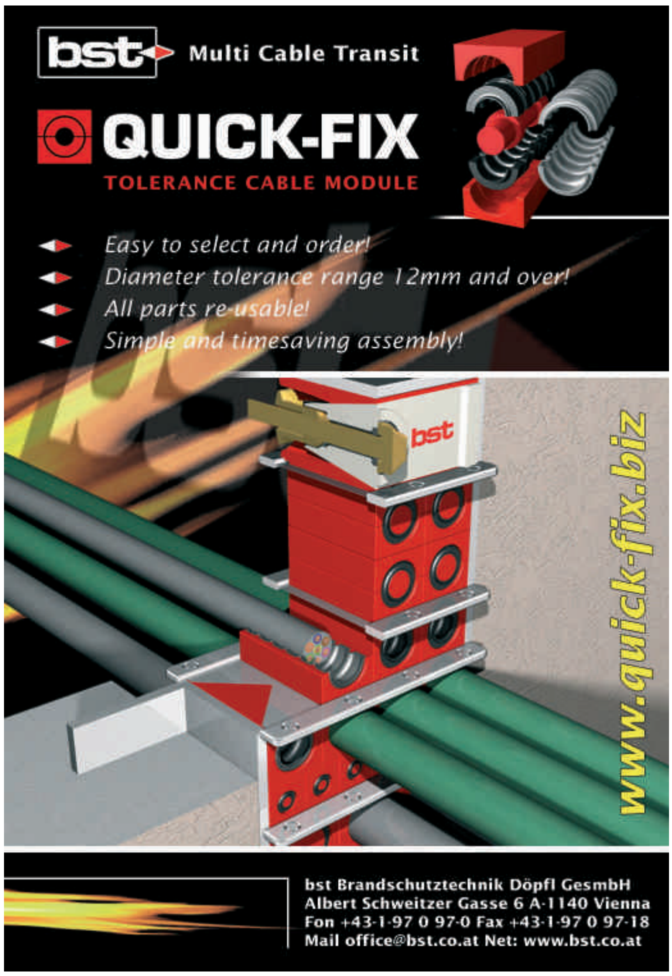
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CGI LAUNCHES FIRESWISS FOAM

Seen for the first time at GP&T, **CGI International** has introduced Fireswiss Foam, a fully insulated fire glass to be sold exclusively in the UK by CGI in a joint venture with the product's Swiss manufacturer. This latest innovation from CGI is the first new product in this category for almost 20 years and utilises a pioneering production process for achieving superior quality and larger sheet sizes.

The concept of CGI has been to offer fire glasses for every performance level from a single source. A stock-able, cut-able insulated fire glass, Fireswiss Foam represents a high value and growing market sector and fills a gap in CGI's otherwise comprehensive matrix of fire resistant glass products.

CGI's Fireswiss Foam is a multiple laminated glass using layers of float glass with silicate laminates. It is available in two basic versions: 15mm thickness for 30 minutes integrity and insulation (30/30), and 23mm thickness for 60 minutes integrity and insulation (60/60). The glass is designed for applications where insulation from both heat transfer and fire spread are required, such as in escape corridors and fire lobbies in multi-occupancy dwellings and public buildings. CGI's Chief Executive, Tom Ritchie comments: "Fireswiss Foam represents a significant new development in this glass type as there are only two other main world sources which have been patent protected."

Fireswiss Foam has successfully completed a series of fire resistance tests to European Standard (EN) 1363 and to British Standard (BS) 476. It has also undergone safety impact tests to EN 12600 – class 1, which is currently the highest. As a result, Fireswiss Foam can be offered to all EU countries, including the UK and other international markets recognising EN and BS standards.

CGI is looking to revolutionise the supply chain for this glass type by making Fireswiss Foam readily available from selected stockists in its nationwide network as part of the complete range of CGI fire glasses.

According to CGI, increasingly stringent legislation has boosted demand for stock-able, cut-able insulated fire glass. Tom Ritchie concludes: "Fireswiss Foam is an excellent example of CGI's commitment to providing fire resistant glasses for every performance level through a combination of our own manufactured products, such as the highly successful Pyroguard range, and exclusive partnerships."

For further information, please contact:
Lesley Hancock, Grenehurst Ltd
Tel: (+44) 01798 875952
Fax: (+44) 01798 875963
Email: lesleyhancock@grenehurst.com

CRANFORD CONTROLS HAS RECENTLY INTRODUCED A NEW AND IMPROVED RANGE OF DOOR RETAINERS AND ACCESSORIES

The new DRW door retainers combine good looks, high performance and economy in one new low profile package.

With a flame retardant, low profile ABS plastic body, the new curvy shape closely matches the curves of the Vantage sounder, making a continuous look possible when installing other Cranford Controls products in high profile applications.

Installation is simple, with knockouts provided for entry of surface mount conduit., with ample room to connect external wiring to the 4.0mm terminals.

Each DRW door retainer is fitted with a spring loaded release pin mounted centrally within the electro-magnet. On power off, the release pin then ensures that the fire door is pushed away from the electro-magnet.

Additional accessory products are available, including floor brackets, chains and additional keeper plates.

All Cranford Controls door retainers are designed to comply to the latest requirements of EN61000-3-2, EN50081-1, EN60950 and EN1155.

Our new DRX range of door retainers is ideally suited to applications where maximum protection is needed against vandalism or accidental damage. It features a rugged cast

aluminium housing, a holding magnet with integral ejection pin and a manual release switch.

With fire safety regulations continuing to have a major impact on the hotel industry, the introduction of a new floor mounted electro-magnetic fire door retainer couldn't be more timely. The DRP pole mounted device provides a flexible solution to the most difficult of installations.

This rugged, versatile design of door magnet can be used for many different door holding applications. With the magnet set as shown in the photograph, the door holder can be floor mounted or ceiling mounted. Turn the magnet through 90° and the door holder is in wall mounting configuration.

The stand and adjustable head are fabricated from steel providing a very robust structure. A moulded cover is included to conceal the mounting fixings once the holder is fitted.

Two standard lengths are available both of which can easily be cut down to shorter lengths on site. Special lengths and voltages are available to order.

As with all our products, next day delivery is standard.

To order please tel. 01420 592 445
or Email sales@cranfordcontrols.com

KLAXON'S ULTRA-BRIGHT DC LED BEACONS ARE IDEAL FOR FIRE APPLICATIONS

Klaxon's standard ultra-bright DC LED beacons, part of the Flashguard Series, have been designed for applications where low current consumption, reliability and synchronised beacon flashing are important, making them ideally suited for security and fire installations.

All LED beacons use 8 high reliability ultra bright LEDs. The 11/35V DC version has zero power consumption when connected in reverse polarity for fire alarm applications. It is also user configurable, providing a choice between flashing or continuous non-flashing options.

Flashguard LED beacons are compact and modern in appearance, with a Fresnel lens for greater visibility and an exceptionally long life compared to traditional types of beacon. They are lightweight, easy to install and weatherproof to IP65.

Four styles are available. Standard and fire models include a terminal block and 27mm deep base which is supplied with a seal and grommet. Fire models also include flying leads. Ultra low profile models come with a screw and nylon wing nut, mounting gasket and 40cm of cable. A low profile style, without a base, is available on request.

An optional weatherproof cable connector is also available to upgrade standard and fire versions from IP65 rating to IP67 for outdoor/storm applications.

High output DC LED beacons are also available as part of Klaxon's Sonos range.

For more information visit www.klaxonsignals.com

NEW MACRON RANGE OF PORTABLE EXTINGUISHERS FROM TYCO

Tyco Fire and Security has introduced a new range of high-performance portable fire extinguishers under the Macron brand. Manufactured in Germany, the range comprises around 60 different models that are suitable for Class A, B and C fires. The line-up also includes models that are appropriate for Class K fires that involve cooking oils and fats. All models comply with EN 3, and models destined for sale in the UK are Kite Marked.

The options include foam, water, dry powder and carbon dioxide extinguishing agents, with capacities spanning from 2kg to 12kg and from three litres to nine litres, depending on the agent. All are guaranteed for five years, providing they are serviced from new in accordance with BS 5306:Pt 3.

The new extinguishers are manufactured by FLN Feuerlöschgeräte Neuruppin Vetriebs, a Tyco company based in Neuruppin, north east of Berlin, which has been manufacturing portable extinguishers for 100 hundred years. They are made to the industry's most exacting standards, and have what Tyco believes is the industry's most hard wearing cylinder coating.

The addition of portable fire extinguishers to the Macron offering is a major boost to its ability to meet the industry's needs as a single-source supplier, with a comprehensive range of cost-effective fire protection products. These include fire hoses and fittings; hose reels and cabinets; foam equipment, monitors and trailers.

For further information, please contact:
Tyco Fire and Security
Tel: +44 (0) 1493 417600
Fax: +44 (0) 1493 417700
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Website: www.macron-safety.com

VDS APPROVES HI-FOG LIGHT AND ORDINARY HAZARD 1 SYSTEMS

Marioff has received a type approval from the German VdS Loss Prevention for its HI-FOG 2000 water mist fire protection system for the protection of European Light and Ordinary Hazard 1 occupancies. The HI-FOG system consists of an electrically- or diesel-driven Sprinkler Pump Unit (SPU) and of unique high-pressure water mist nozzles and other components.

The HI-FOG 2000 fire protection system has been approved to be used for the protection of light hazards (LH) and certain ordinary hazard (OH1) risks as defined in the VdS CEA 4001. These include occupancies having conditions similar to offices, banks, conference rooms, schools, universities, hotels, hospitals, foster and old peoples homes, apartments, prisons, reformatory institutions, and restaurants. Some special conditions for kitchen areas, computer rooms, storage areas and libraries apply.

Marioff has now received four VdS type approvals for different HI-FOG systems protecting European Light and Ordinary Hazard 1applications as well as turbine and machinery applications. In addition, Marioff GmbH – Marioff's subsidiary company in Germany – is the first company listed by VdS as an approved installer and designer of water mist systems in Germany.

HI-FOG technology has a large collection of type approvals also from various other approval bodies and classification societies around the world, such as the FM Approvals of the USA.

For more information please visit www.marioff.com or contact info@marioff.fi

THE BRIT OVAL IS BOWLED OVER BY MILLBANK

As a challenging project, **Millbank**'s PA/VA solutions has provided Surrey County Cricket Club's Brit Oval with a powerful multi-functional system that combines its pre-requisite evacuation facilities with entertainment and presentation capabilities, in line with the demands of a contemporary systems' design.

Vision Systems Neil Voce explains:

"It became apparent early on that the system would also need to control sound in the older Pavilion End and also be able to accept inputs from this end for commentary etc. It also became apparent that the 80's system fitted at that time was not covering the client's basic requirements. It was only really operating as one single zone and was devoid of any of the main safety features such as battery back up.

The installation of the new system using fireproof cable and offering 8 separately addressable zones began in January and is now complete. The installation has been a complex project due to the age and of the Pavilion, which comprises three different buildings, which have now become unified under one system."

Hilton's combined Millbank VxLAN digitally distributed voice network, with one rack in each building. This configuration allows for four simultaneous channels of audio to be broadcast across the network.

The VxLAN multiplexes these at 20-bit 20Hz – 20kHz audio quality onto one single cable pair. We actually provide two separate cables to provide a dual redundant ring system between the outstations, each of which has four zone outputs. This single pair of cables also carries all of the monitoring information from the remote amplifiers back to the master station where this information can be displayed on a screen or similar.

The amplification is all using a Class 'D' technology, a concept that uses a very fast switch to create the audio output. A traditional amplifier set a current flowing between the voltage rails and used pretty much the same amount of power regardless of its output at any single moment. The ultimate traditional amplifier would have been a Class 'A' valve amplifier, where you can see the energy being burnt in the glow of the valves, even when the amplifier is silent. The Class'D' amplifier only delivers any power output when required to create an audio output. By having a switch operating at around 500,000 times per second, the amplifier rebuilds the audio waveforms, to be amplified, essentially, without waste.

In a world where whole life costing is important and energy is only to become more expensive in the future, Class 'D' is a step forward. This lack of waste also means that there is a lack of excess heat and this means that amplifier heat sinks and therefore overall amplifier size can be radically reduced. Thus, Millbank's DsPAC 3U amplifier frame can carry 5 250W power amplifiers and operate at room temperature without forced cooling. And, it is not to be overlooked that this is only an evolutionary stage of this technology – undoubtedly there is more to come.

The Millbank system installed at The Brit Oval successfully combines the features that are strictly pre-requisite for evacuation with those deployed to enhance the venue as a prestigious corporate hospitality environment.

For further information, please visit:
www.millbank.co.uk

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The Use of Alternate Materials and Methods in Fire Protection Design

Mark Budzinski, C.B.O.
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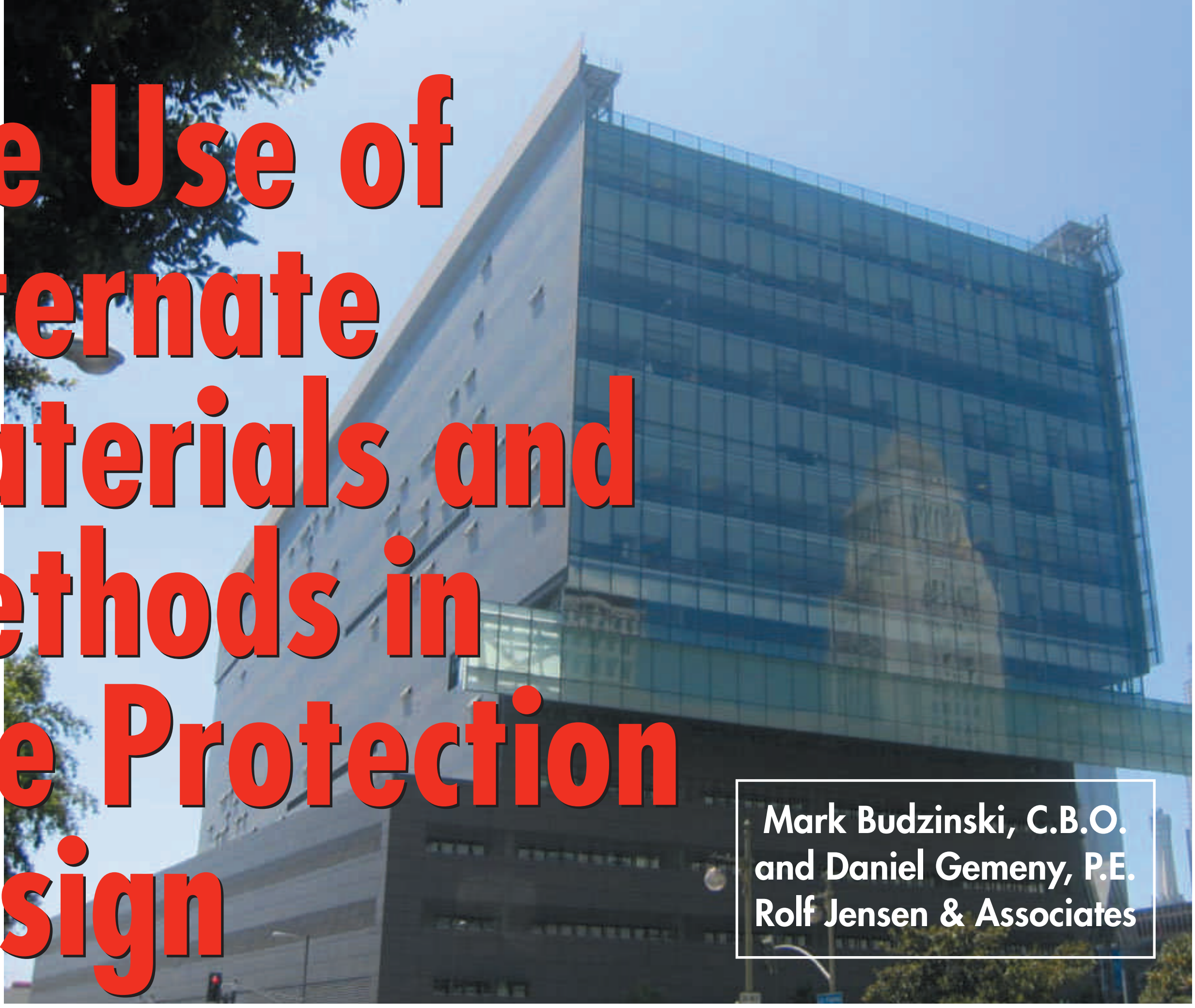


Unconventional architectural features often benefit from the use of alternate methods in fire protection design

IT MIGHT BE CONSIDERED radical to suggest that building codes are the seedbed of innovation. However, the portfolio of striking design elements by the current breed of architecture's finest designers was often made possible through the skillful use of somewhat obscure building code administrative provisions that are intended to promote new thinking and new methods. Although the building codes used in the United States are typically used prescriptively by applying code requirements in a specifically defined manner, these model codes also provide options for achieving equivalent levels of performance through alternate methods.

The model codes are not intended to prevent the use of materials, alternate designs or methods of construction not specifically prescribed by the code. In fact, the code provides broad opportunities for innovation.

Nonetheless, a design that deviates from the prescriptive code requirements must be found equivalent to the prescriptive code provisions in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation. In order to demonstrate this, the authority having jurisdiction (AHJ) requires evidence or proof.

PROCESSES

The burden of providing evidence or proof will rely upon a solid understanding of the process and the effectiveness of the request. The process of pursuing an alternate material, design or method can vary between jurisdictions.

Although the formal request will generally describe the code issue, the code intent, code analysis and a justification for the proposal, it culminates in the preparation of a formal request for consideration by the AHJ.

Although the rationales for a particular request may vary, the merit of a request will typically be judged by the analysis and the quality of the engineering supporting the request. Effective approaches will typically rely

Although the formal request will generally describe the code issue, the code intent, code analysis and a justification for the proposal, it culminates in the preparation of a formal request for consideration by the AHJ.

The Use of Alternate Materials and Methods in Fire Protection Design

upon a combination of engineering analysis, code analysis, engineering judgment and performance-based design methods.

Less objective proposals that are not rooted in an engineering methodology are often the hardest to evaluate and justify. If subjective proposals for alternate methods are approved, they often result in requirements for arbitrary mitigating design features which may not provide benefits that address the issues associated with a particular alternate material, design or method. As jurisdictions become more accustomed to requests for alternate methods, they often become less inclined to approve subjective proposals without an engineering basis.

Nonetheless, even when well-equipped with supporting engineering, the often uncharted nature of alternate method requests can present conflicts between AHJs and the design team. Although AHJs are sanctioned to enforce minimum standards to safeguard life or limb, health, property and public welfare, designers may have competing objectives.

Accordingly, a design team motivated by design expression or innovation will often test the bounds of acceptable code norms in ways that may create discomfort towards or reaction against a design proposal because of unfamiliarity, fear or justified concern about the erosion of effective code requirements. The safest position for an AHJ is to default to the rejection of any alternate request – it is unlikely that an AHJ will be accused of negligence for adhering to the strict letter of the law.

However, the AHJ may be motivated by external factors that influence the policies of municipalities. As cities compete to attract the attention of high-profile projects in order to generate tax revenue and to enhance their reputation, AHJs are increasingly encouraged by elected officials to be responsive to alternate methods. Additionally, as alternate methods become more normalized in practice, these approaches become increasingly viable to achieve project delivery objectives. As more advanced tools to support the requests become available and the design community becomes more aware of the possibilities, alternate methods will likely be embraced more frequently.

APPLICATIONS

Within the discipline of fire protection engineering, typical candidates for alternate requests often include exit system design, smoke detection and sprinkler system design elements, opening protection, fire-resistance and smoke control systems. Although various engineering methodologies and tools exist that are suitable for evaluating the merits of particular approaches to achieving equivalency, the emergence of graphical engineering tools has lead to broader acceptance of the use of alternate materials and methods in fire protection design.

Some of these tools include timed-egress computer models that graphically display exit system performance, fire dynamic simulators and heat transfer models. A benefit of these tools is the ability to visually correlate aspects of a particular design with two- or three-dimensional effects. Moreover, once modeling inputs are established, various outcomes can be studied by varying design inputs. The benefits of dynamically observing modeling performance is a key selling point when presenting the evidence to a building or fire official; moreover, the engineer has greater analytical tools available to facilitate the design evaluation.

EXIT SYSTEM DESIGN

The number, location and width of exit components such as doors and stairways are a design consideration in all buildings. The challenges of balancing multiple design considerations with exit systems code requirements are magnified as occupant loads and building

The benefits of dynamically observing modeling performance is a key selling point when presenting the evidence to a building or fire official; moreover, the engineer has greater analytical tools available to facilitate the design evaluation.

areas increase. Moreover, programmatic objectives, effective space utilization and design expression often create additional tension with exit system code requirements.

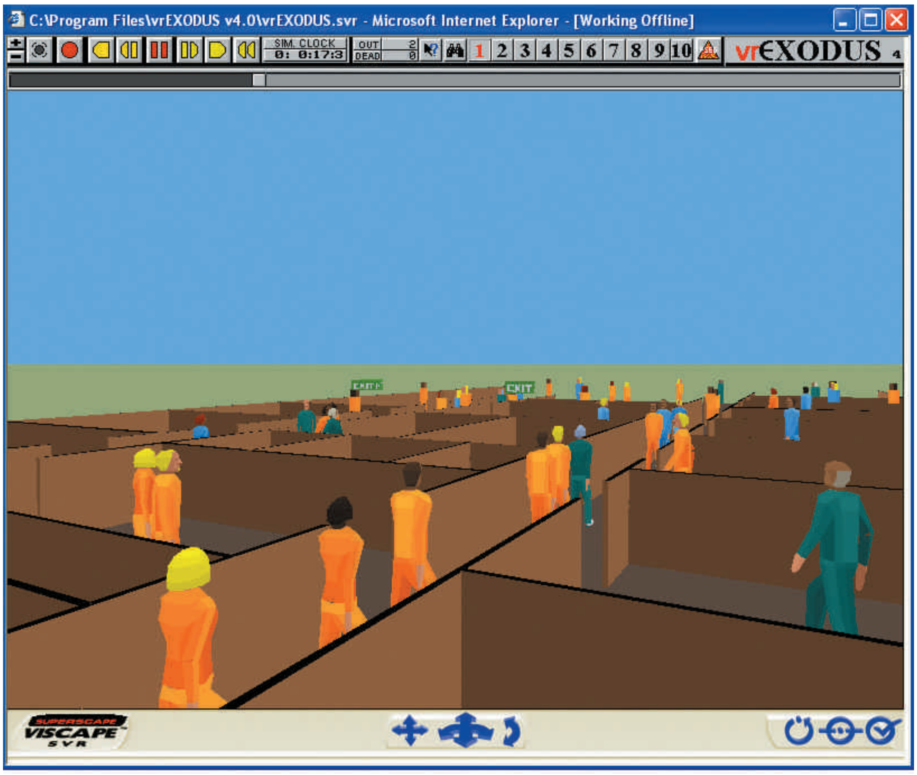
The intent of the prescriptive code requirements for the exit system design is to provide a safe and reliable means of egress before the onset of hazards from a fire or other emergency. Nonetheless, the considerable amount of useable floor area dedicated to the provision of required exit system components can be considerable; this is particularly evident within large assembly buildings and structures with expansive footprints or floor plates.

Convention centers and warehouses have one common trait when it comes to exit system design, long travel distances to an exit. This is due to the open floor plans that are necessary for storage and exhibits. The functional needs of these buildings conflict with the maximum travel distance prescribed by codes. Traditional solutions have included the addition of fire-resistive walls subdividing the space, or the introduction of subterranean exit passageways.

A recognized method for evaluating other alternatives is the use of fire effects models and egress models. These engineering tools allow the designer to evaluate the time to exit across longer distances to an exit and the impact of additional fire safety features to mitigate any unacceptable effects from a fire. Through the utilization of these tools, architects will often achieve their design objectives through the provision of mitigating fire protection features without compromising overall project objectives.

SMOKE DETECTORS AND SPRINKLERS

The prescribed location of smoke detectors and sprinklers can, at times, be in conflict with building architectural features. Ceiling configurations that are aesthetically compromised by inflexible positioning requirements of fire protection system elements can often benefit from a coordinated engineering approach. Alternate locations of these devices can be considered when the performance of the device is shown to be equivalent to its intended function.



Timed egress model used to demonstrate the flow of occupants out of a building

Show systems within amusement attractions, suspended sculptural elements or highly articulated ceiling systems can all present conflicts between design elements and fire protection system device positioning requirements. The obstruction of ceiling-mounted sprinklers by a full scale whale replica suspended from a ceiling in an aquarium building is one example; another is the requirement to install smoke detectors in each pocket of a ceiling with deep beams on a six foot grid. In both of these examples, engineering analysis was used to justify the alternate placement of fire protection system elements in order to achieve the desired objectives.

OPENING PROTECTION

Many buildings require fire-resistive compartmentation with listed wall and floor assemblies. Although openings within fire rated assemblies, such as doorways and windows, must be protected with listed fire protectives, architects often desire to have glazed openings in fire-rated wall assemblies. The opening protection requirements for doors and windows often impinge upon the desire for visual connection between adjoining building spaces or building porosity. The default option of specifying wired glass is generally not acceptable due to aesthetic considerations, and dimensional constraints

The obstruction of ceiling-mounted sprinklers by a full scale whale replica suspended from a ceiling in an aquarium building is one example; another is the requirement to install smoke detectors in each pocket of a ceiling with deep beams on a six foot grid.

The Use of Alternate Materials and Methods in Fire Protection Design

often rule out the use of a rated shutter to protect the glazed opening.

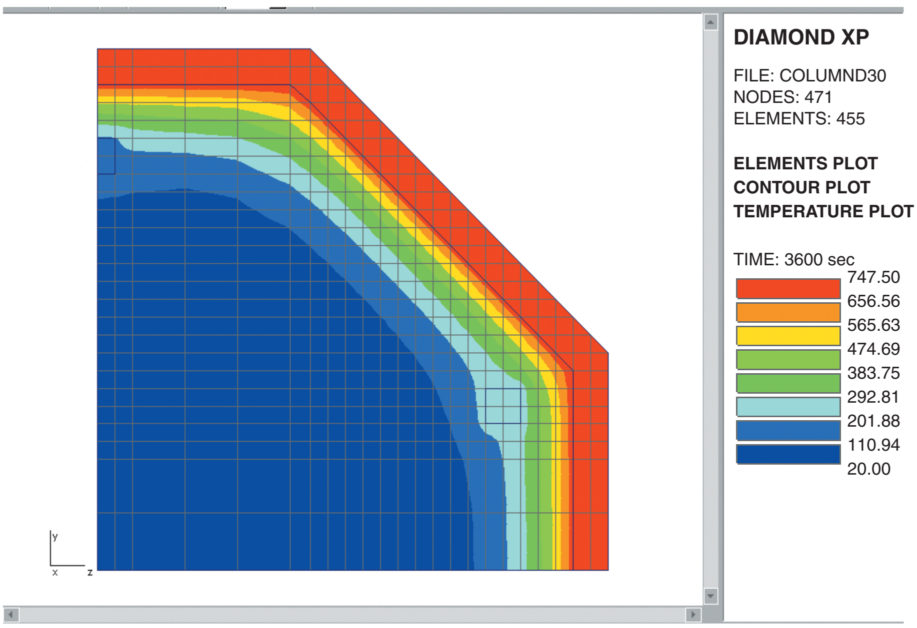
An alternate design solution that is commonly sought is the protection of an opening with an engineered system in lieu of a listed fire protective assembly. The use of closely spaced quick-response sprinklers directly above the glazing has been a widely accepted alternate solution to provide an equivalent level of opening protection with an aesthetically unobtrusive impact.

FIRE RESISTANCE

Alternate designs for fire-resistive assemblies are also common in commercial building construction due to the desire for structural expression. There are several methods available to demonstrate equivalent performance of an alternate assembly, including standard fire testing, heat transfer/structural calculation, and empirical methods such as Harmathy's rules.

When fire tests are not practical and an empirical solution does not exist, engineering calculations, using recognized equations or models can result in a definitive solution. For example, a unique column design, with a reinforced concrete core and a steel wrap, was proposed for use in the lobby of a performing arts theater. A heat transfer/structural performance model SAFIR was used to predict the fire resistance and integrity of the column subjected to a wide range of fire exposures.

On a smaller scale, a heat transfer analysis was conducted on a custom fireplace to be installed in a private home. This effort was needed to demonstrate that the performance of



A lateral section of a column showing temperature distribution (SAFIR)

Engineered solutions have resulted in approved designs in buildings such as federal courthouses, student centers, historic theaters, and covered mall buildings.

the fireplace was equivalent to the standard set for all listed residential fireplaces.

SMOKE CONTROL

Buildings that have large open volumes, with interconnected floor levels, such as malls and atria, are required to have smoke control systems. Traditionally, smoke control is provided by mechanical exhaust systems that remove smoke from the large volume space to prevent it from becoming smoke-filled before the occupants exit safely.

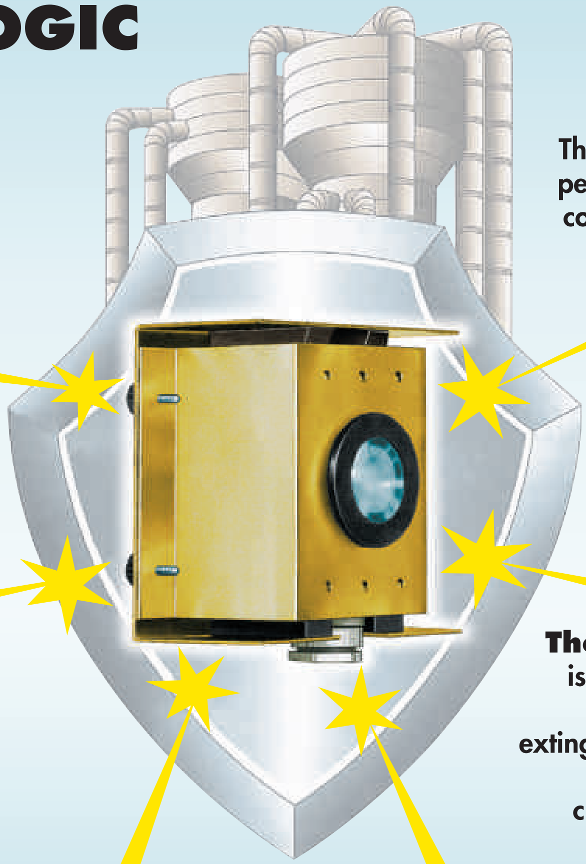
The code has evolved in recent years from prescribing smoke exhaust rates of six air changes per hour to a performance method requiring mechanical exhaust rates that are based upon the volumetric smoke production rates of possible fires. However, recent interest in green building design has increased the demand for alternate solutions with natural smoke ventilation in place of dedicated smoke fans. Engineered solutions have resulted in approved designs in buildings such as federal courthouses, student centers, historic theaters, and covered mall buildings.

UNCERTAINTY

There is often significant uncertainty in the actual performance of many

CONTROL LOGIC Spark detector

designed for dust collection systems to protect storage silos from the risk of fire.



Sparks fly at high speed.

They travel at a hundred kilometres per hour along the ducts of the dust collection system and reach the silo in less than three seconds

The CONTROL LOGIC SPARK DETECTOR is faster than the sparks themselves. It detects them with its highly sensitive infrared sensor, intercepts and extinguishes them in a flash. It needs no periodic inspection.

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For industrial applications indoors or outdoors where is a risk of explosion and where the explosionproof protection is required.
One detector can monitor a vast area and responds immediately to the fire, yet of small size.

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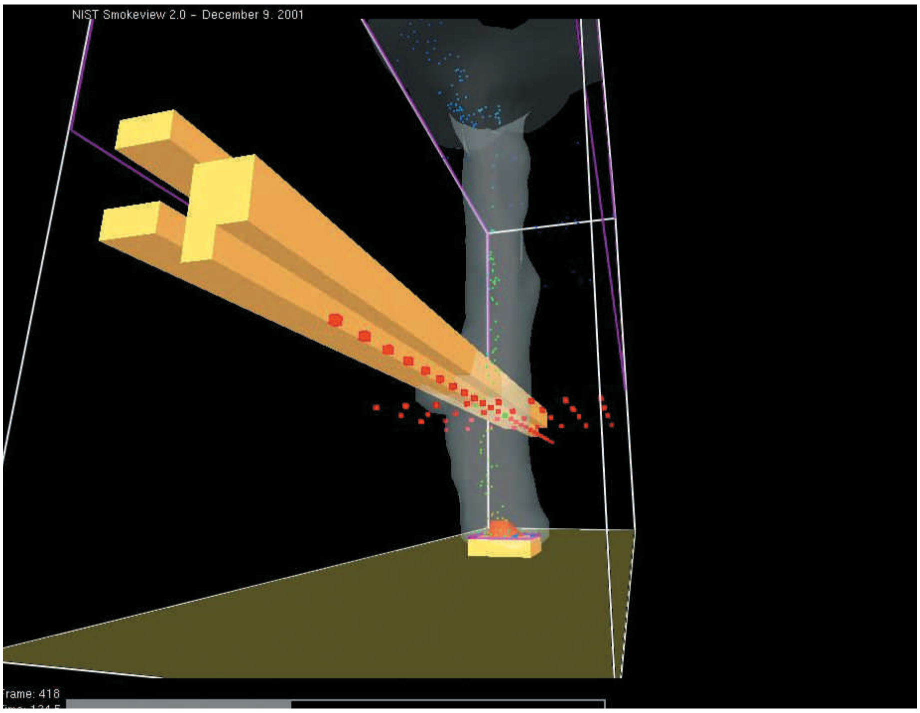


A fire plume exposure to a sprinkler protected steel beam

alternate designs that are proposed and accepted during the design and construction of a building. The reduction of uncertainty in any alternate or equivalent design or material will result in buildings that are more efficient and safe from the threats of fire. The areas of uncertainty that should be considered include:

■ **Qualitative Solutions** – These are alternate designs that are often the result of negotiation between the proponent and the AHJ that rely on past precedence, expert opinion, and sometimes by give-and-take of mutually exclusive fire protection features. The results can range from overly conservative to non-equivalent.

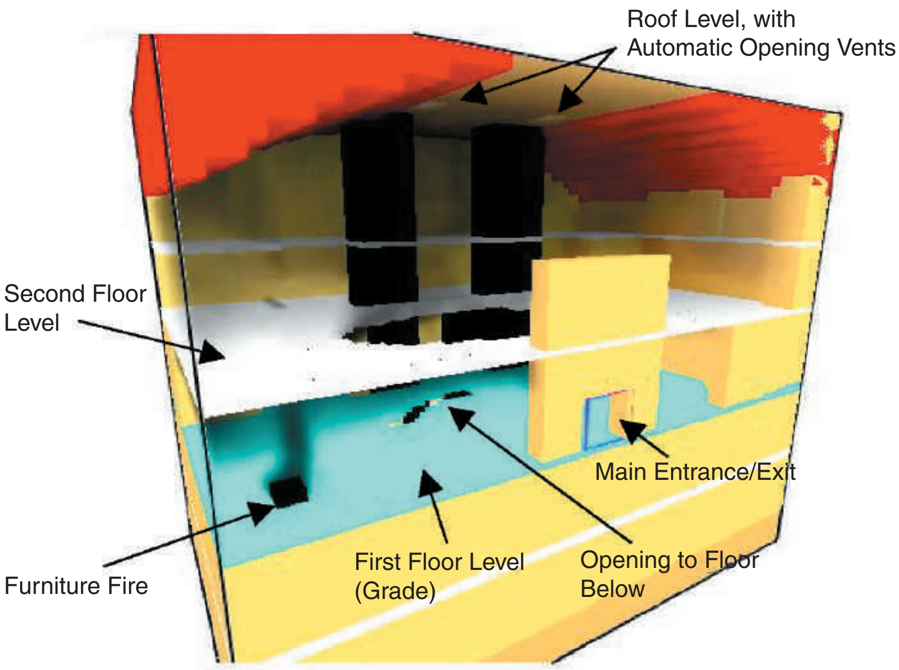
■ **Quantitative Solutions** – Alternate designs that are engineered with the use of recognized calculation methods and models can often get closer to demonstrating equivalent performance to the prescribed fire protection solution. There is inherent uncertainty in the calculation methods and data that is used in an analysis, however a quantitative solution is easier to defend.

■ **Individual vs. Whole Building** – Many building designs depend upon a few alternate design solutions which are often considered in their individual context, such as relocating a few sprinklers in one room and using sprinkler protected glass on the exterior of the building. However, there are examples of buildings that may have in excess of 100 different alternate designs. The combined impact of all the alternates on holistic building fire performance is not known.

■ **Code Intent** – The alternate designs are required to provide an equivalent level of fire safety as intended by the code prescription. There is no reference that is available to the designer or AHJ that defines the intent of the prescriptive requirements. The lack of clarity of the intent of a given code requirement results in a large degree of uncertainty in the correctness of the solution.

CONCLUSION

The alternates and equivalency sections of the U.S. Building and Fire Codes have created many opportunities to develop the practice of fire protection engineering. These code sections are also substantial drivers for the current evolution of performance-based fire safety design, technological innovation and design expression in the built environment. As engineering tools advance, the use of alternate methods will expand—the result will be the innovative use of engineering tools to facilitate new thinking, new methods and better design.



This is a view of the top three levels of the five-story atrium space. The cyan color of the floor represents the main entrance/exit level, which includes lounge seating and waiting areas for a performance arts theater. The file shows 3D "smoke" from a sample furniture fire on the entrance/exit level

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Kidde Fire Protection

Fire Suppression Solutions

FM-200®

CO_2

Argonite

3M™ Novec™ 1230
Fire Protection Fluid

Water Mist

With a bewildering array of fire suppression products available today, it's hard to know which one to use for your specific application.

Kidde Fire Protection's total capability in fire suppression offers unbiased guidance, enabling you to select the right fire suppression product.

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Clean Agents: The Big Picture

By Lee James

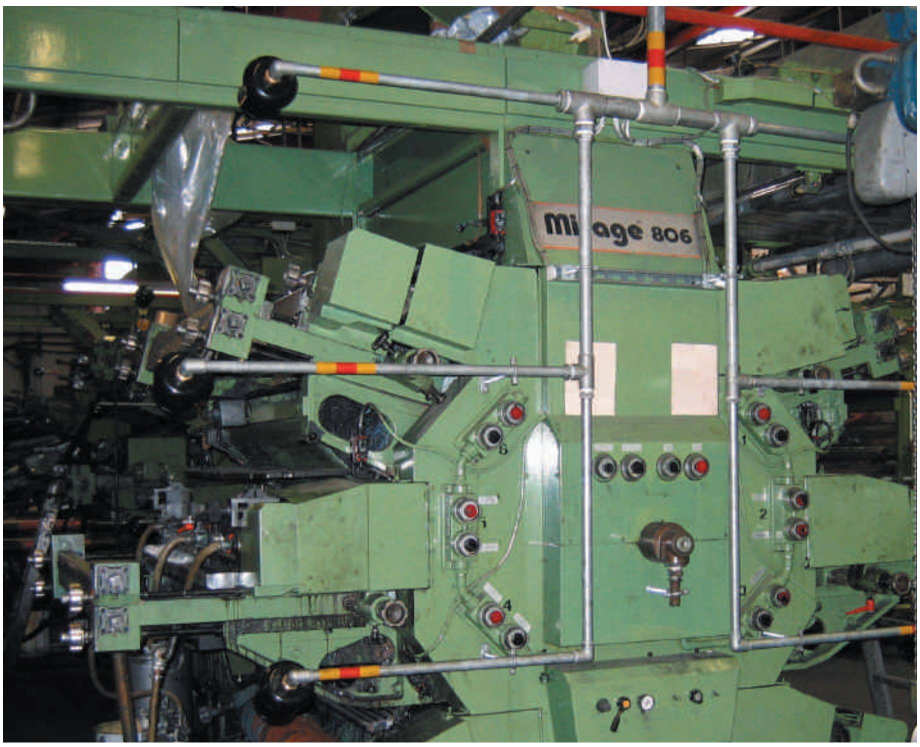
Kidde Fire Protection 25 Bar System Cylinders for 3M Novec 1230 Fluid

CLEAN AGENTS DON'T LEAVE behind any oily residues, particulates, water or corrosive materials. In other words, they don't cause collateral damage to whatever they are protecting from fire. That's why they are used extensively around the world to protect business-critical computer and telecoms rooms, and also precious artefacts in archives, museums and art galleries.

Until recently, Halon 1301 was the leading clean agent. However, its phase-out for environmental reasons has led to a bewildering choice of alternatives. No single clean agent currently available is suitable for all applications, and so the unique properties of each agent must be carefully matched to each application.

Factors that need to be considered when selecting the most appropriate suppression system for each application are the physical dimensions of the risk; whether or not it is occupied by personnel; weight/space limitations for suppressant storage; fire fighting performance; environmental credentials; and of course the overall cost of the system.

No single suppression agent is suitable for all applications, and each must be carefully weighed up in relation to its suitability for any given risk. All too often the process of selecting the most appropriate suppression solution is made difficult by unfounded rumours and misinformation put about by organisations with vested commercial interests in a limited number of agents. In contrast, this article provides unbiased guidance from a source with experience in the manufacture and design of all the major clean agent technologies.



6 CO_2 discharge nozzles protect 6-colour printing press

CO_2 Discharge on Jet Engine Test Rig

THE SUCCESS OF CO_2

Carbon Dioxide (CO_2) was the original "clean" gaseous fire suppression agent pioneered by Kidde over eighty years ago. Since then it has safely extinguished more fires than any other gaseous agent.

CO_2 expands on release to form a combination of gas and fine particles of solid CO_2 or "dry ice". The gas penetrates the hazard area and extinguishes the fire primarily by reducing the oxygen concentration in the atmosphere to less than 15%. In addition, as the dry ice sublimes (changes to gas) it provides localised cooling. The dry ice particles also enable the extinguishant to be projected over much greater distances than would be possible with gas alone.

The versatility of applications is what gives CO_2 its true uniqueness. It has physical characteristics that allow it to be used to suppress fires in a wider variety of applications than any other gaseous agent. It is effective on a broad range of Class A, B and electrical fires. It can be used as a "total flooding" agent in enclosed spaces, or in "local application" for unenclosed equipment protection, or in a combination of both. Most other clean agents have only total flooding capabilities.

Another big advantage of CO_2 is that it is relatively inexpensive. This is because the cost of storage and distribution is spread over a wide range of industries, most notably beverage carbonation. This also means that CO_2 is readily available world wide for low-cost re-charge.

CO_2 occurs naturally in the atmosphere and therefore has no restrictions on its use in fire fighting. It has a zero Ozone Depletion Potential (ODP) and a Global Warming Potential (GWP) of one.

It is well known that CO_2 at fire extinguishing levels can cause death by asphyxiation to personnel who might inadvertently be in the hazard area. While it is widely used in unmanned applications, it is also acceptable for use in manned areas provided suitable safety measures are adopted. These are covered in NFPA 12, BS 5306 Part 4 and manufacturers' safety and operation manuals. CO_2 has a proven track-record of safety when these simple measures are taken. Over 100,000 systems installed world wide over the past fifty years show that it can be used safely.

WATER MIST

Even though it is not gaseous or classified as a clean agent, water mist is worthy of mention since it is increasingly being used in certain applications such as gas turbine enclosures. Water mist systems, such as Kidde AquaSafe, use the most natural of substances, deployed as a highly efficient fine mist made up of ultra-fine droplets in the range of 40 to 400 micron in diameter. They work by a combination of cooling

CO_2 Storage and distribution control system for multi-zone risk

NN100

Clean Agent Fire Suppression System

Nohmi, always the pioneer in the fire protection field in Japan, have paid thorough effort to give a shape to an ideal fire suppression system which must give no adverse effect to the natural environment and have the affirmative capability of fire suppression. As a result, Nohmi successfully developed the NN100 system by employing nitrogen gas as an agent which is 78% of the air. When you think of safety against fire, the environment, protection against property damage, cost and space saving, NN100 is highly recommended as the best fire suppression system.

NN100 is available from our distributors in Thai, Indonesia, Philippines, Vietnam, Singapore,Malaysia, China, Taiwan, Jordan, U.A.E, Kuwait, Qatar, Saudi Arabia, Tunisia, Bangladesh, and India.

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Kidde Fire Protection 25 Bar System Discharge Nozzles for 3M Novec 1230 Fluid

and inerting and also have the added advantage over gaseous systems of removing airborne smoke particles and absorbing water-soluble toxic and irritant gases.

It must however be remembered that water mist is not a total flooding agent and is transient in nature. It must be recognised that permanent extinguishing may not be attained if re-ignition sources are present.

INERT GASES

These are a blend of gases that occur naturally in the atmosphere. Those most commonly used are argon, nitrogen and carbon dioxide. They are popular with organisations that prefer to use a non-chemical suppression agent. With zero ODP, zero GWP and zero atmospheric lifetime, inert gases have excellent environmental characteristics.

Inert gas suppression systems, such as Kidde Argonite, work by displacing oxygen and reducing it from the normal 21% to a level that will not support combustion. A typical design concentration of 40% will reduce the oxygen level to 12.5% within 60 seconds. In occupied areas personnel can continue to breathe safely at this level for short periods of time.

The space requirement for inert gas storage cylinders is greater than that needed for chemical agents, although the latest systems with cylinder storage pressures of 300 bar offer significant space savings over equivalent 200 bar systems. The cylinders are mounted in rows and may be stored in any suitable location, even in excess of 100 metres away from the protected areas.

CHEMICAL GASES

With hundreds of thousands of systems installed in over seventy countries world wide, the most widely used Halon replacement is a hydrofluorocarbon (HFC) called HFC-227ea.

HFC-227ea works by absorbing heat from the flame and the fuel, reducing the temperature to a point were the flame can not sustain itself and the fire is extinguished. It provides rapid suppression, with a short discharge time of typically 6 to 10 seconds after fire detection. With a relatively small cylinder storage footprint HFC-227ea is ideally suited to use in areas were space is at a premium or weight restrictions apply.

The largest manufacturer of HFC-227ea is the US-based Great Lakes Chemical Corporation, recently re-named Chemtura. Known as FM-200™, its product is the most comprehensively tested clean agent in history. Over $20 million has been spent by Great Lakes on toxicology and safety testing. It is completely safe for use in occupied areas within prescribed concentrations and exposure times. It is so safe that it has even been designated as a replacement for CFCs as a propellant for pharmaceutical metred-dose inhalers (MDI).

HFC-227ea has a zero ODP, a low GWP and a short atmospheric lifetime of only 29 years. Since its environmental impact is negligible, it is likely to remain a viable agent for many years to come. Perhaps the best evidence for this is the fact that the US Environmental Protection Agency recently installed HFC-227ea systems to protect sensitive equipment at its National Computer Center in North Carolina.

Kidde Fire Protection Inert Gas System

Protect your high value assets and your world

Never under estimate the chance or the effects of fire. i3™ inert gas systems provide the rapid, efficient response required to effectively protect against virtually all combustible material and flammable liquid fires.

Most importantly, i3™ inert gas is entirely environmentally friendly as its component gases (Argon / Nitrogen) already circulate freely in the atmosphere And this agent has no impact of any kind on climate change.

Breathe freely, protect your high value assets and enjoy your planet.

- Fast acting
- No environmental impact
- Low life cycle cost
- Electrically non-conductive
- Zero breakdown products
- No risk of consequential damage
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Email: macron-info@tycoint.com Web: www.macron-safety.com

Kidde Fire Protection Inert Gas System

NEWEST TECHNOLOGY

The latest arrival on the fire suppression market is 3M™ Novec™ 1230 Fire Protection Fluid. It differs from conventional chemical agents in that it is stored as a liquid and, thanks to efficient nozzle technology, is discharged into the hazard zone as a colourless, non-conductive and non-corrosive gas. The agent does not disrupt the operation of electronic equipment even when in its liquid state. This has been graphically demonstrated by mobile phones being shown to work even when fully immersed in the fluid!

The big advantage of Novec 1230 fluid is that it has negligible impact on the environment. Known chemically as a fluoroketone, its greatest appeal is with companies where environmental considerations are high on the corporate agenda. Its impressive "environmental footprint" credentials include a zero ODP, an GWP of just one and a remarkably low atmospheric lifetime of only 5 days. It satisfies not only today's environmental regulations, but also meets all of those in the foreseeable future.

Novec 1230 fluid puts fires out quickly by reaching its extinguishing concentration in 10 seconds or less. It works by absorbing heat from the fire rather than oxygen depletion. It has the highest heat capacity of any commercially available chemical agent, giving it the lowest extinguishing concentration of 4 to 6 percent.

Novec 1230 fluid is people-friendly too. It presents no risk to personnel in occupied spaces at normal design concentrations. The US EPA Significant New Alternatives Program (SNAP) has classified it as acceptable for use as a total flooding agent in occupied spaces. In fact, its low extinguishing concentration (4-6%) in combination with a high No Observable Adverse Effect Level (NOAEL) of 10 percent means that it provides a safety margin of nearly 100 percent. This is by far the largest safety margin of any clean fire suppression agent currently available.

Novec 1230 fluid systems are available in 42 and 25 bar versions. While 25 bar systems are the most

When selecting the most appropriate clean agent for your particular application, it is wise to seek guidance from an unbiased source with access to all of the options, rather than an organisation with only a limited range of products.

Lee James has over twenty years in the fire protection industry, and in that time has built up a world wide reputation as an acknowledged expert on clean agent fire suppression systems with a background in design and installation. He is currently Product Manager at Kidde Fire Protection responsible for the global marketing of all the major suppression technologies including CO_2, FM-200™, Argonite™, and 3M™ Novec™ 1230 Fire Protection Fluid.

cost-effective, 42 bar systems offer increased design flexibility for large or complex pipe runs.

THE SMALL PICTURE

When selecting the most appropriate clean agent for your particular application, it is wise to seek guidance from an unbiased source with access to all of the options, rather than an organisation with only a limited range of products.

Once the most appropriate agent has been selected for your particular risk, you are still only half way towards a solution! Whichever agent has been selected, the importance of ensuring that your system is properly designed, installed and maintained cannot be overstated.

As a minimum you should make sure that:

- appropriate system design has been carried out by trained and certified engineers.
- system components comply with all relevant legislative requirements such as US DOT and EU TPED for cylinders and PED for pressure components.
- systems have an independent third party approval such as UL, FM Global, LPCB and VdS.
- installation is carried out by properly trained and certified engineers to ensure your system operates as intended.
- maintenance is carried out in accordance with manufacturers' instructions and relevant Codes such as NFPA 2110 and ISO 14520.

Setting th

THE NEAR IMMINENT ARRIVAL of the British Government's RRFSO [Regulatory Reform (Fire Safety) Order], with its emphasis on risk assessment rather than prescribed fire safety measures, is focusing attention on the need for third party certification throughout the industry. Here, Fred Tingle, Chairman of the Institute of Fire Prevention Officers' Technical Committee, takes a close look at the issues involved.

By Fred Tingle

The new RRFSO applies only to the UK, and does away with Fire Certificates issued by local fire brigades, to be replaced by what could be described as "self assessment" based on fire risk assessments. This reflects a growing international trend for fire safety to be based on the application of fire engineering techniques rather than prescribed solutions. The inevitable consequence of this is that compliance with recognised standards and advice contained in guidance notes is taking on an even more important role. Fire safety professionals and facilities managers alike are seeking assurances that the products and systems being designed, manufactured, installed, commissioned and maintained are "as described", and fit for the purpose for which they are intended.

By their very nature, standards are created to provide end-users with a guide as to what performance is required under defined circumstances, what is recommended, or what level of performance or protection needs to be achieved. However, it is increasingly being recognised that third part certification is essential if users are to have confidence that a product reaches the standards it purports to attain. The reality of the situation is that, while products that are not third party approved may well be designed and built to the required standards, there is no way in which this can be verified. In my opinion, achieving a third party approval is vital.

In Europe, we have CE marking. But what does CE marking really imply? The letters CE on a product are the manufacturer's claim that the product meets the requirements of all of the relevant European Directives. So, the marking on a product is supposed to indicate to governments that the product can be sold legally and move freely throughout the European Union and the Free Trade Area. It also offers the manufacturer's assurance that the product meets designated minimum safety standards and, therefore, a minimum quality standard, and that it can be relied upon to promote public health and safety. From the manufacturer's perspective, CE marking also enhances the product's credibility, in the hope of leading to increased sales and greater customer satisfaction.

All well and good, but it must be remembered that we, and our European customers are relying on the manufacturer's honesty. CE marking is a manufacturers claim; it is not certified by a third party. Hence the added importance of insisting on products or services that also comply with the appropriate British Standard or other qualified certifying authority, and be third party certified.

Since the revised edition of British Standard 5839 Part 1 in 2002 (amended 2004) – Fire detection and alarm systems for buildings; code of practice for system design, installation and servicing – there has been growing awareness of the need for such standards in world markets. This is particularly so, now that so many fire detection and alarm products and systems are manufactured "offshore". Additionally, we sometimes tend to overlook the fact that the marketplace for such products and systems is now worldwide, and that to compete in these markets, it is essential to comply with the host country's standards, where they exist.

By their very nature, standards are created to provide end-users with a guide as to what performance is required under defined circumstances, what is recommended, or what level of performance or protection needs to be achieved.

e Standard

Many countries readily accept British and EN standards as a satisfactory qualifying standard, but this is not the case throughout the world. Manufacturers marketing globally are only too aware that products aimed at a world market may well demand modifications to their specification for that product to be acceptable.

There are, of course, situations that cannot be totally covered by the relevant country's standards and markings, although the product may well perform satisfactorily. For example, when a new and innovative technical development comes along, it will mainly depend upon the number of manufacturers of similar products as to whether it is deemed necessary for a standard to be created. The creation of a standard is by no means a simple or inexpensive task. It takes an enormous amount of time to get agreement on the appropriate level that the standard should indicate as acceptable, and it is of no use to create a standard that is impossible for the manufacturers concerned or other agencies to achieve, while at the same time creating a meaningful quality standard.

Most, although by no means all, of these comments apply to products and systems. However, equally important is the question of the installation designer, installer and maintainer competency. After all, there is little value in specifying even third party certified equipment if best practice is not delivered by those responsible for the application of those products and systems. It is interesting to note that research indicates that the majority of false alarms are installation or building management related rather that being due to faulty equipment!

It is interesting to note that research indicates that the majority of false alarms are installation or building management related rather that being due to faulty equipment!

Clearly, we need to be working towards better and more reliable measures of acceptable competency. While training and experience are vital, surely there is also a need for independent accreditation that is not reliant upon the individual company's commitment or professional integrity. A number of the leading trade associations are taking a praiseworthy lead on this issue, some of which, equally commendably, are also third party endorsed.

When a new and innovative technical development comes along, it will mainly depend upon the number of manufacturers of similar products as to whether it is deemed necessary for a standard to be created.

Fred Tingle retired as Gwent's Senior Fire Safety Officer in 1993 after 31 years in the fire service. A Fellow and Vice Chairman of the Institute of Fire Prevention Officers, he is a member of its Executive Council. He also runs his own fire safety consultancy, Fire Hazard Technology.

IFPO

The IFPO, which incorporates the Institute of Fire Safety Officers, represents fire safety officers working in the private and public sectors. Its aims include the advancement of fire safety education; the maintenance of high professional standards among members, and to advise, inform and educate members in all aspects of the fire safety industry. Further information is available on the Institute's website at www.fire.org.uk/IFPO/

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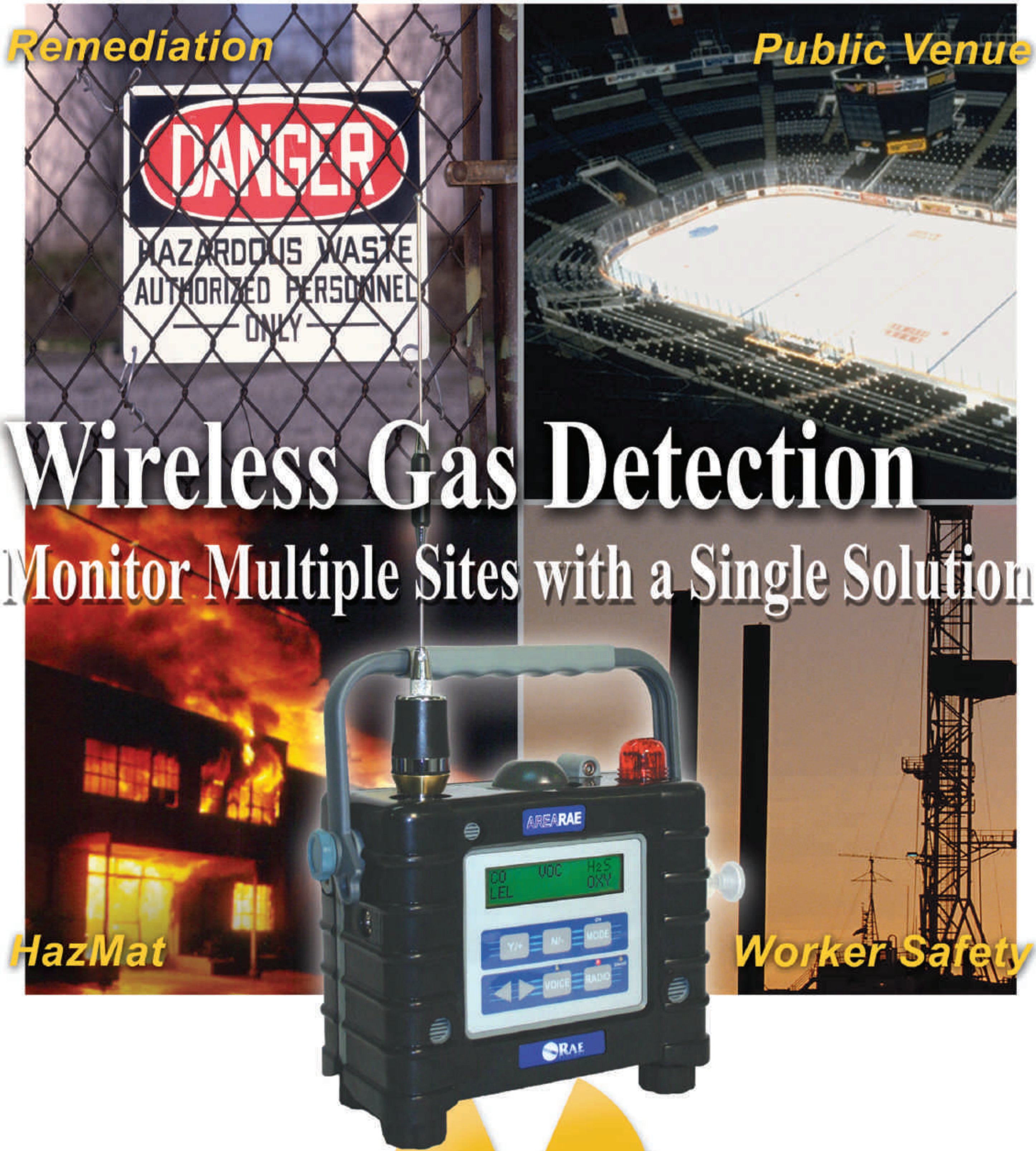

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Fixed Gas Detection Systems

EEx d and EEx n gas detectors

By Dr G. Frigo

DECISIONS BASED ON COMPLIANCE WITH STANDARDS

UNTIL RECENTLY, MANUFACTURERS OF gas detection systems, installers, general contractors and "end-users" could rely on only a few reference standards for the manufacture and installation of fixed gas detection systems, which were not mandatory and were sometimes unclear and incomplete.

With the introduction of the two Directives and the new standard for functional safety (see figure "The Sensitron Hexagon"), all these subjects will be able to refer to a specific source. Thus, this decision shall no longer be optional, but binding and shall include disciplinary provisions and sanctions.

The most important factors that need to be taken into consideration for the selection of the most appropriate gas detection system will be dealt separately in an abstract divided into 4 parts, each one examined individually.

1. Directive 94/9/EC, introduced on July 1st and known as ATEX 100a (from the French acronym ATmospheres EXplosives), establishes the ESR (Essential Safety Requirements), specifies provisions for the manufacture of equipment depending on the degree of the hazard of the area, outlines the procedures which have to be followed to certify the equipment, identifies the notifying bodies authorized to certify this kind of equipment and illustrates the procedures which have to be followed to monitor the manufacture of equipment suitable for the above-mentioned areas.

The Directive also specifies the PERFORMANCE that this equipment should exhibit to be regarded as SAFETY DEVICES, regardless of whether they are fixed or portable: a factor that is often neglected and not implemented by local bodies. In other words, a device with an ATEX certified housing does not have the necessary requirements to be certified as a gas detector. In accordance with the Directive, a device can be classified as such only if it is certified in accordance with the performance criteria defined in the Directive and more specifically in standard EN 61779-1 and subsequent amendments. Manufacturers who fail to comply with this standard, installers who install, and users who use devices which are not certified with this standard, will not comply with the Directive, because devices that are regarded "gas detectors (Safety Device)" are not simply devices fitted in a ATEX certified housing.

The Directive ATEX 100a will be examined in greater detail in part 2 of the above-mentioned abstract.

2. Directive 1999/92/EC, also known as Directive ATEX 118a, will come into force on July 1st 2006.

While Directive 94/9 focuses on products and was addressed mainly to manufacturers of gas detection systems, this Directives applies in particular to the installers and users of said systems, because it specifies the minimum requirements which need to be met to enhance the safety and protection of the health of workers exposed to the risk of atmospheres classified as potentially explosive.

The Directive explicitly lists the duties of "Employers" in terms of classification of the area and the actions that have to be implemented to prevent and/or foresee adequate protective measures against explosion hazards.

Fixed Gas Detection Systems

This Directive follows Directive 89/391/EEC, whose purpose was to implement, document and update explosion hazards. In Italy, D.L. (Law Decree) 233/2003, which came into force on 10.09.2003 and integrates the general duties specified in D.L. (Law Decree) 626/94, specifies that employers have to perform specific assessments and also prepare specific documents detailing the measures implemented to prevent said hazards. The law decree also specifies sanctions for the failure to comply with these requirements.

All working sites used for the first time after July 1st 2003 must immediately comply with the Directive, while existing ones shall have to do so by June 30th 2006.

A more detailed analysis of the duties of the employers and of the classification of these areas is provided in point 3 of the above mentioned abstract.

3. The first part of the document examines the basic concepts of gas detection, with topics that range from the specific nature of gases, the concept of explosiveness, the Minimum Ignition Energy (MIE) and toxicity.

These concepts are essential to understand that process followed by law issuing bodies to create and issue the two above-mentioned directives and other European Standards (EN), to which CENELEC 31 and 31-9 Committees have greatly contributed.

The incorrect interpretation or the lack of information on these basic requirements, which include concepts like specific density that is important to determine the correct location of detectors, or the selection of improper detection principles for a specific gas may have a negative impact, even if the detector has been manufactured and tested according to the standards.

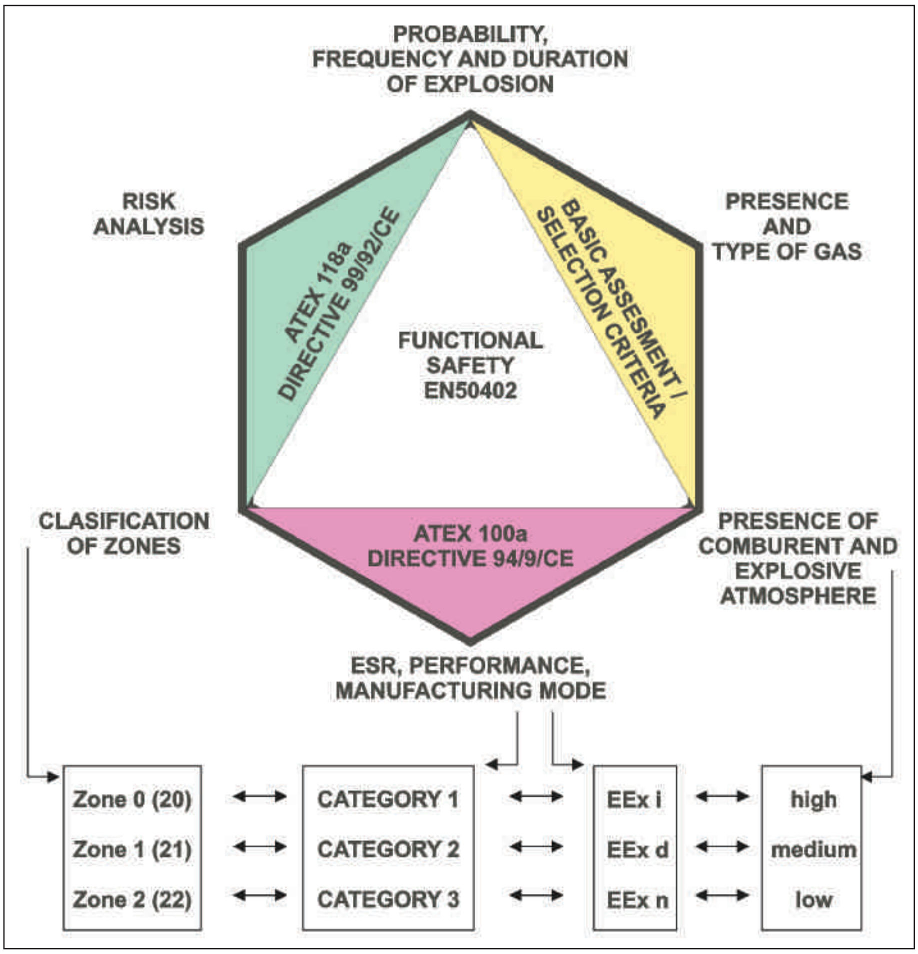
4. The last part of the document, part 4, which is equally important, examines the new European Standard EN 50402 which has been approved in the last few days and which examines the concepts of "Functional Safety", i.e. the reliability of a gas detection system.

Although it is important to verify that the gas detector is manufactured in accordance with the explosion and electrical requirements of the area in which it will be installed, correctly classify the area on the basis of specific criteria, assess risks and correctly install the detectors, it is equally important to assess and classify the equipment or gas detection system also in terms of functionality or probability of failure.

Standard EN 50402 (which is a standard, not a directive) classifies systems in several levels that enables users to ensure that the reliability of the gas detection system complies with the reliability of other systems already installed in the production area.

More specifically standard EN 50402 – "Electrical Apparatus for the detection and measurement of combustible or toxic gases or vapors or of oxygen. Requirements on the functional safety of fixed gas detection systems" – defines the functional modules and illustrates the combinations that can be used for safety purposes.

The document also examines the



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Fixed Gas Detection Systems

evolution of the process which has led to the unification of general standards into a single draft and explains how to classify traditional gas detection systems in accordance with the new standard.

Directive Atex 100a establishes that all European countries must carry out type tests on:

- Gas detection systems with measuring functions aimed at preventing explosions, as per EN 61779-1 and subsequent amendments
- The requirements which need to be followed to measure oxygen, as per standard EN 50104
- Gas detectors that have to be used to measure toxic gases, as per standard EN 45544-1 and subsequent amendments

All these measurement standards define standard performance requirements, but do not provide information on functional safety in the event of failure or on the requirements that have to be met to guarantee continuity of operation in the event of failure.

Currently used gas detection systems have a complex modular structure, are controlled by microprocessors and are used for the most diverse applications with varying levels of safety. The complex range of measurements that have to be performed to ensure functional safety are now disciplined by this standard.

The general standard that disciplines the "functional safety of electronic systems" is standard.

EN 61508, which defines specific performance requirements depending on the level of safety (from SIL 1 to SIL 4, Safety Integrity Levels).This standard, which is constituted by 7 sections, is very large, but also rather generic. In most cases, the standard provides only theoretic guidelines or recommends the use of complex mathematical calculations to estimate potential risks.

All this is very challenging from the scientific point of view, but not very practical.

The second European standard that disciplines the functional safety of electronic control systems is standard EN 954-1, which specifies the generic requirements of the Machinery Directive in function of the categories of risk (from Cat 1 to Cat. 4). By definition, these categories are explicitly "not hierarchic in terms of requirements", but can be integrated in a hierarchic system. The definitions of standard EN 954-1 are much more pragmatic and in many cases much more practical than those of standard EN 61508.

The scope of standard EN 50402 is that of unifying (combining) the concepts and of defining the requirements for a family of products, or in other words of specifically adapting generic requirements to gas detection systems.

The basic approach of this new standard is to supply a unique description of gas detection systems, which may be constituted by different hardware components, depending on manufacturers. Gas detection systems are specifically divided into functional modules. The standard specifies, for each module, detailed requirements, dividing them by levels which range from SIL-C 1 to SIL-C 4 (Safety Integrity Level Capability).

Depending on manufacturing characteristics, functional modules may belong to different hardware components. The standard describes the following functional units:

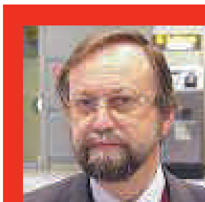
- Gas sampling (4 different modules)
- Sensor
- Signal transmission (2 distinct modules)
- Input to control units (5 distinct modules)
- Processing of signals in the control unit (5 distinct modules)
- Outputs from control unit (5 distinct modules)

Risks (Fault tolerance) are estimated by comparing the percentage of safety relevant faults with the total faults, taking into accountant the redundancy level defined in standard EN 61508. Risks are divided into risks related to simple modules (faults with non predictable characteristics) and complex modules (like microprocessors).

Fault probabilities have been formulated taking into account previous experience with gas detection systems and the practical applications of standard EN 954-1 within the ambit of the Machinery Directive.

The integration of gas detection systems in a global safety system offers the possibility of carrying out a larger number of risk analyses (ATEX 118a) and of managing risks more effectively. In future, there will be an increasing number of application specific gas detection systems based on the SIL-C classification

Sensitron srl, which has always developed innovative gas detection systems and promoted manufacturing processes focused on quality and the compliance with standard, shall be happy to provide the abstracts of parts 1-4 quoted in this documents to anyone having interest therein.



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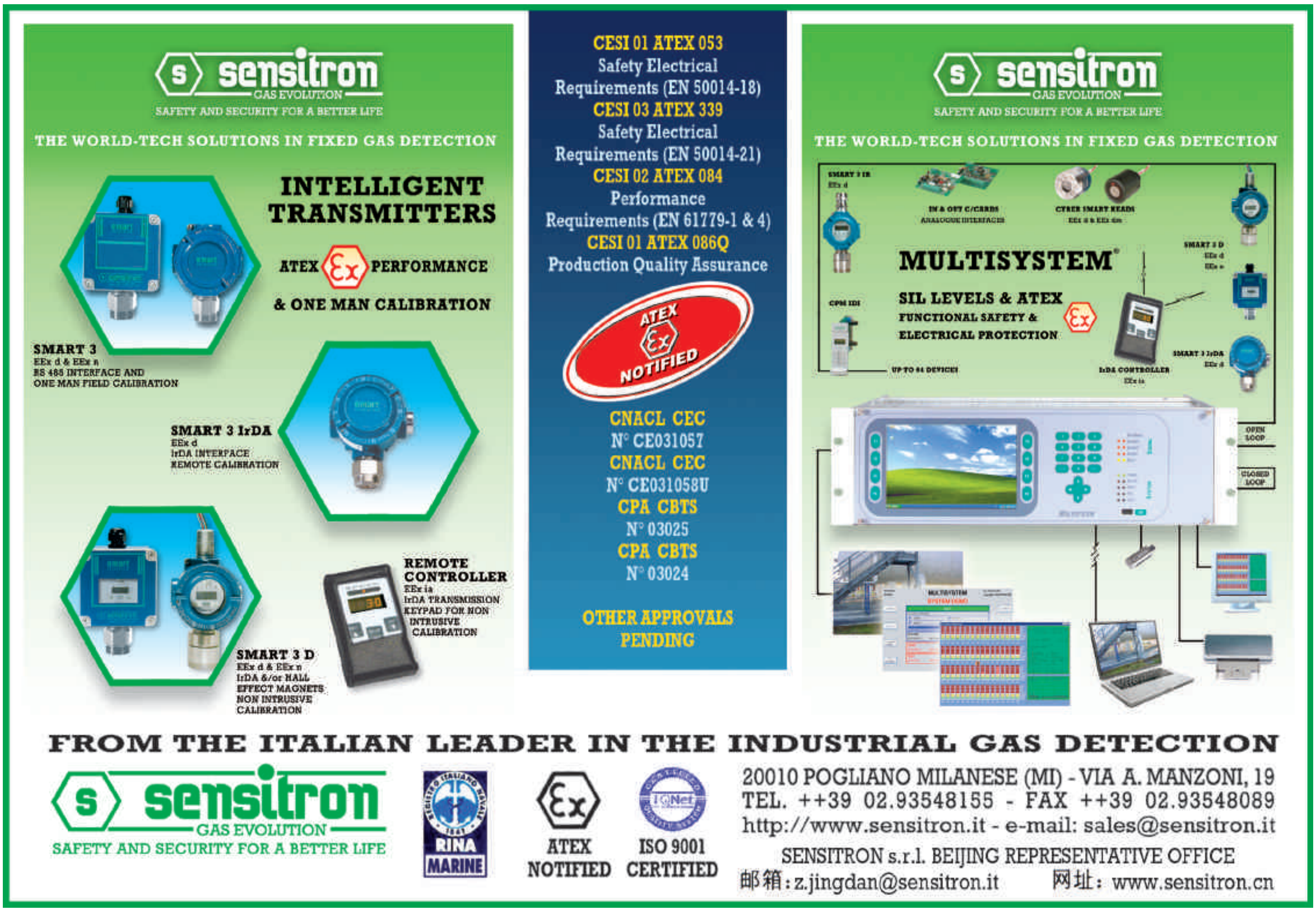
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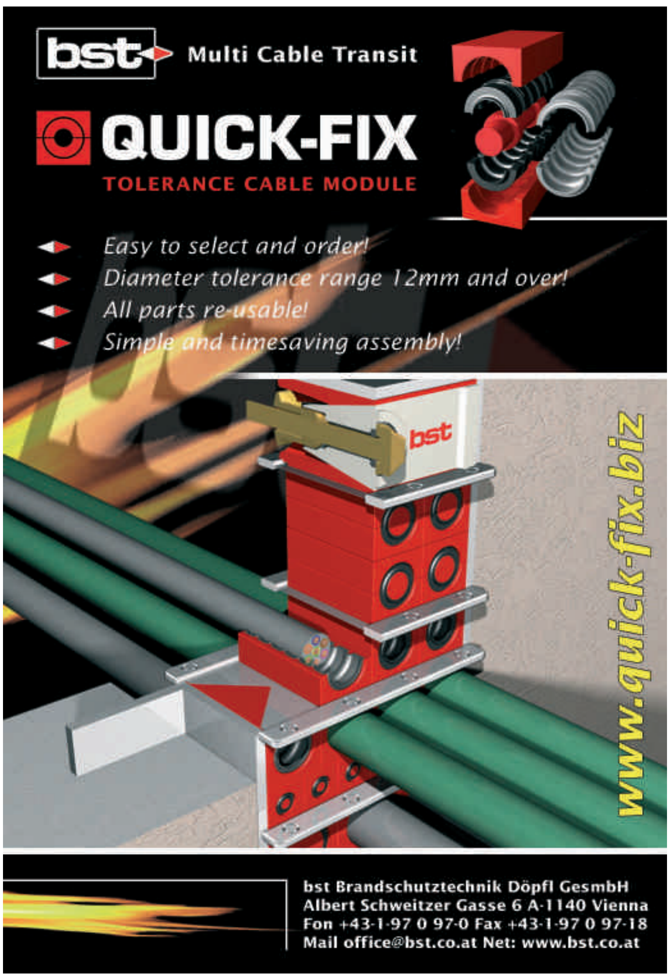
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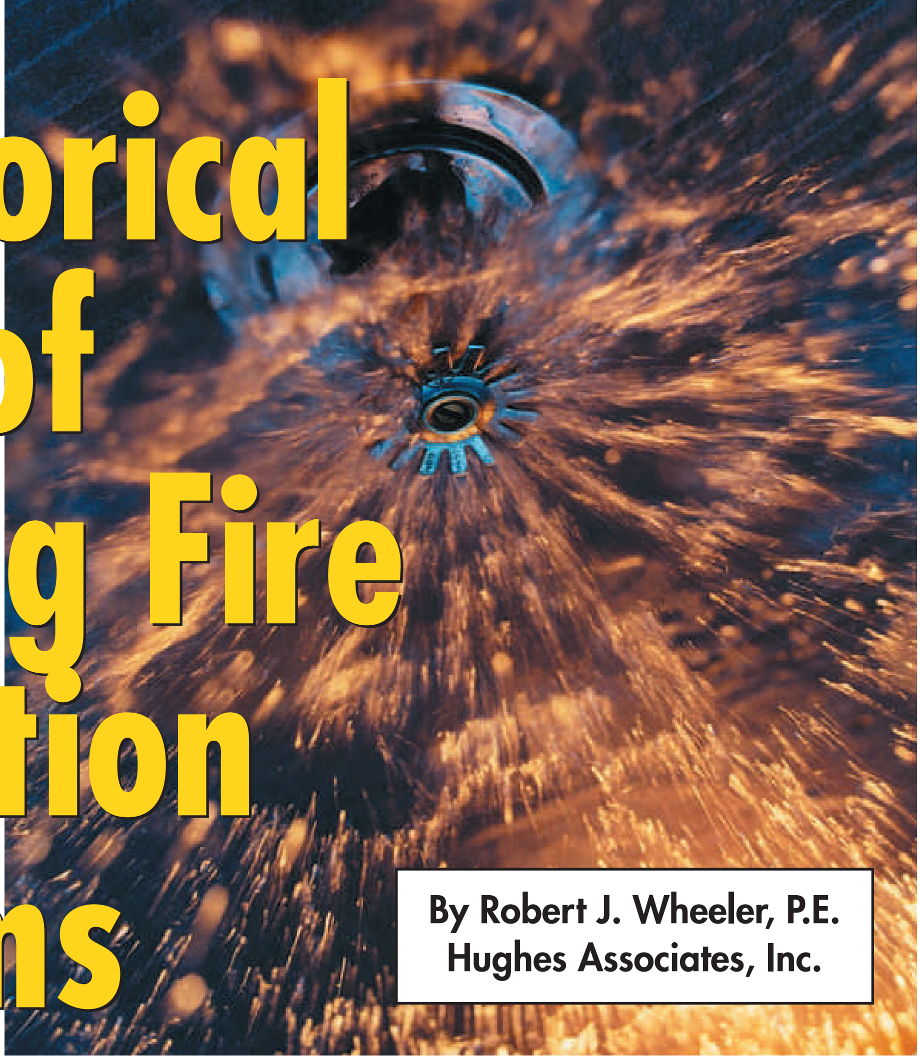
A Historical View of Building Fire Protection Systems



By Robert J. Wheeler, P.E.
Hughes Associates, Inc.

THE HISTORY OF FIRE protection in buildings dates back thousands of years. A single article cannot fully explore the many aspects of its evolution. However, a number of events, people and inventions have been significant in the evolution of fire protection in buildings. These are discussed in this article as central to the acceptance and advancement of fire protection systems, particularly automatic fire sprinkler systems. Although fire protection in buildings includes various types of systems, this article will largely focus on the evolution of sprinkler systems. Sprinklers are generally regarded by fire protection engineers, insurance companies and property owners as the most effective protection for both property protection and life safety. They have an established record of efficiency and reliability in controlling and extinguishing fires.

Fire is essential to human survival. However, an unwanted fire is a destructive event, causing millions of dollars in damage in addition to pain and suffering. Laws against setting or causing fires go as far back as Hammurabi and Leviticus (circa 1780 BC).[1] For centuries, fire prevention was simply keeping things that burn away from flames. However, over 800 years ago in 1189, Henry Fitz-Ailwyn, the first Lord Mayor of London, issued a regulation prescribing fire safety features for buildings which included a requirement for stone party walls to be 3-feet thick and 16-feet high and for combustible construction to be covered with slate or burnt tile.[1]

Sprinkler Head by Reliable Sprinkler Inc.

AUTOMATIC FIRE SPRINKLERS

A critical advancement in building fire protection was the emergence of fixed fire suppression in buildings. Efforts to incorporate fire suppression in buildings began in the nineteenth century with the advent of perforated-pipe systems. In 1806, John Carey of England conceived of the idea of a heat-activated device, which would distribute water through a system of perforated pipes installed within the building or area to be protected. Carey's concept was developed further by Major Stewart of London's 1st Engineer Volunteers who introduced the first automatic sprinkler in 1864.[2]

During the same time period Henry Parmelee, a piano manufacturer from Providence, Rhode Island, was also developing this concept to protect his piano factory. These systems were manually activated by the opening of a control valve and distributed water over the entire area covered by the system. Subsequently, manually activated

A Historical View of Building Fire Protection Systems

perforated-pipe systems were installed in a number of manufacturing plants in New England. Although these systems were an improvement over manual suppression, by the end of the American Civil War concerns over the reliability of these systems, which discharged water over the entire protected area rather than just in the vicinity of the fire, began to emerge.

THE PIONEERS

Although Major Stewart introduced the first sprinkler in 1864, credit for establishing the sprinkler's practical application and current base of acceptability throughout the world is credited to Henry Parmelee and Frederick Grinnell. Attempts were made to develop automatically actuated systems which would limit discharge over the area of the fire thereby reducing water damage. In 1874 Henry Parmelee was awarded the first patent for an automatic sprinkler system. Although the perforated-pipe system was patented by American Philip W. Pratt of Abington, MA in 1872, Parmelee is credited with creating the first commercially successful closed sprinkler. Frederick Grinnell patented his first automatic sprinkler in 1875 which used a more sensitive solder element in the fusible link and provided an improved response time. Refinements in automatic sprinkler designs led to their increased use in the United States and Europe. By 1884 ten companies had automatic sprinkler approvals, and the use of automatic sprinklers in buildings began to spread to Europe (1884) and Canada (1889).[1]

In order to be successful, an invention must not only meet a need, it must also be economical. George Parmelee, Henry's brother, recognized that the cost of installing automatic sprinklers would have to be offset by reduced insurance premiums in order to entice property owners to bear the cost of their installation. George traveled to Europe in 1881-1882 and, through a series of fire tests, demonstrated the effectiveness of automatic sprinklers. He also educated the insurance companies on the value of automatic sprinklers in reducing property losses.[2] This marks one of the initial efforts at demonstrating the benefit/cost of incorporating a fire suppression system in building design.

During the same time period, Sir William Mather, a member of the Royal Commission on Technical Education, traveled to America in 1883 to gather design, installation and performance data on sprinkler systems. While visiting the United States he met Frederick Grinnell. Grinnell, who had an association with Parmelee, manufactured the Parmelee sprinkler and also designed and installed systems using them. A mechanical genius, Grinnell successfully improved upon the Parmelee invention and created the "Grinnell" sprinkler. Shortly after Sir Mather's visit to the U.S., the British Tariff Insurance Companies decided to give official recognition to the Grinnell sprinkler and grant rebates for its installation.[2] This action provided significant momentum for the use of the sprinkler system.

Around 1880 the Factory Mutual Insurance Companies began to encourage policyholders in the U.S. to install automatic sprinklers and offered premium concessions. Factory Mutual also began to test and approve automatic sprinklers.[1] The use of schedule ratings for determination of insurance premiums also promoted the use of automatic sprinklers since the lack of certain fire protection systems was charged as a deficiency under the schedule with the result being higher premiums.[1] In addition, around 1884 the insurance industry included coverage for non-fire water damage, i.e., accidental discharge, from automatic sprinkler systems. This action further encouraged their use.

EARLY STANDARDS

On October 22, 1885 British engineer John Wormald copyrighted and published the first code of Sprinkler Rules which was adopted by the British Tariff

Pic courtesy of Tyco Safety Products

A Historical View of Building Fire Protection Systems

Insurance Companies.[2] Not only did these rules form the groundwork for similar rules subsequently established in America, they were also adopted by Australia in 1939. The National Fire Protection Association (NFPA) was formed in 1896. Membership consisted of stock insurance companies that were interested in improving their surveillance of risks. The first NFPA project was to formulate standards relating to automatic sprinklers. The initial edition of this standard, which utilized the pipe schedules developed by Freeman, was used for approximately ten years. Many systems originally designed and installed using this standard remain in service today.[1]

Despite the advancement of sprinkler system technology in the 1800's, hydraulic calculations had not yet been developed. Therefore all sprinkler systems were based on pipe-schedule tree-systems with no more than six sprinklers placed on a branch line.[1] Around 1905 observations of fires and loss experiences determined that the size and severity of fires was a function of the combustible materials in the area, both in terms of types of materials and arrangement. It was also noted that sprinklers on more than one branch line were usually involved. As a result, the original pipe schedules used for sprinkler installation were revised. The revised schedules set a limit on the number of sprinklers per branch line in addition to the total number of sprinklers on a given diameter of pipe collectively throughout the system.[1] These revised pipe schedules remained in use until the middle of the twentieth century. Subsequent improvements to sprinklers in regard to effectiveness, cost reduction and increased longevity resulted in low-maintenance and effective fire protection systems. By 1911 approximately 100,000 buildings in the U.S. were protected by automatic sprinkler systems.[1]

A water-mist nozzle undergoes "K" factor testing to determine flow characteristics

PARALLEL DEVELOPMENTS IN DETECTION AND ALARM

An important parallel development in building fire protection was that of fire detection and alarm technologies. Alarm systems were developed beginning around the middle of the nineteenth century. In 1847 New York City began construction of a municipal alarm system, followed shortly thereafter by Boston in 1851. In 1882 an early heat detector, consisting of a glass tube filled with alcohol, was developed in Germany by Haase.[1] The first electric fire detector in commercial use was developed by William B. Watkins. Watkins also developed the first remotely monitored fire alarm system using heat detectors in the early 1870's. The first residential fire detector appeared in 1921. Today, residential smoke detectors are commonplace life safety devices. Detection systems are also commonly used for special suppression system activation such as gaseous systems and pre-action and deluge sprinkler systems.

In 1909, Mr. Edward Hope Kirkby, an Australian inventor introduced the first automatic clockwork fire brigade alarm transmitter which transmitted a signal to the nearest fire station when a building's sprinkler system activated. Australia was the first country to introduce the automatic fire alarm transmitter.[3] Combining an automatic alarm system with an automatic water suppression system may have been the single most important fire protection engineering concept of the late nineteenth century and was a significant factor in helping automatic sprinklers gain wide acceptance.[1]

IMPORTANT CHANGES IN BUILDINGS

A number of building and industrial processing changes occurred in the first half of the twentieth century that directly affected the continuing evolution of sprinklers.[1] They included the following:

1. Steel and concrete replaced wood as the dominant material for construction. Therefore the need to discharge water to the underside of the roof, as was the case with old-style sprinklers, became less important.
2. Greater floor-to-ceiling heights resulted in a longer distance that water from a discharging sprinkler had to travel to reach the fire. More heat was absorbed during this descent which resulted in a higher evaporation rate and less water remaining to reach the fire.
3. Changing storage technologies, such as rack storage, presented more challenging fire scenarios.

EXPANDED ROLE FOR AUTOMATIC SPRINKLERS

Until the late twentieth century sprinklers were primarily used for property protection in commercial applications. However, the record in sprinklered buildings demonstrated that they had value as a life safety system as well, thereby expanding the role of automatic sprinklers in buildings. Today sprinklers are acknowledged for their life safety benefit as well as for property protection.

The lack of sprinklers in residential occupancies such as single family dwellings has been due mainly to several issues. First, the quantity of water usually available was much less than in commercial properties, therefore standard spray sprinklers could not be used due to their pressure requirements. Second, materials found in residential occupancies generally tend to liberate more toxic products of combustion when burned and standard spray sprinklers could not react quickly enough to provide adequate egress time for occupants. And finally, sprinkler systems were not yet affordable in residences. Advancements in sprinkler system technology have addressed these as well as other technical issues, resulting in the development of relatively lower cost sprinkler systems for dwellings. But despite many advantages, the use of these residential sprinklers has not met expectations. Even when an adequate water supply is available their use is limited. Resistance to residential sprinklers is similar to that experienced with the introduction of old-style sprinklers in the late nineteenth and early twentieth century: indifference, fear of water damage and affordability. Today their use is largely limited to those jurisdictions where they are mandated.

Pic courtesy of Marioff Hi-Fog

> *Resistance to residential sprinklers is similar to that experienced with the introduction of old-style sprinklers in the late nineteenth and early twentieth century: indifference, fear of water damage and affordability.*

OTHER FIRE SUPPRESSION TECHNOLOGIES

In the early twentieth century, carbon dioxide was becoming an important industrial gas used in industries such as soda manufacturing, dry ice and inert manufacturing processes. As the use and production of carbon dioxide grew its cost dropped and it became a readily available, cost-effective extinguishing agent. The first widespread use of carbon dioxide was in small hand-held extinguishers. The manual use of carbon dioxide eventually created an interest in using it in automatic extinguishing systems; the first use of which was for the protection of fur vaults. First addressed

by J. C. Hesson in 1953, developing an understanding of CO_2 flow characteristics in piping was one of the most important and difficult fire protection engineering challenges of the twentieth century. Hesson proposed a method for calculating the pressure drop for high-pressure carbon dioxide in pipes. Hesson and others (1957) subsequently developed more sophisticated methods which were demonstrated to work for low-pressure systems by a series of tests. This development allowed the low-pressure carbon dioxide storage units to be located remotely from the hazard to be protected.

Halogenated extinguishing agents also appeared at this time with considerable research taking place between 1945 and 1955. However, concerns over their toxicity and their decomposition products as well as the fact that carbon dioxide was much less expensive slowed their use in suppression systems. By the middle of the 1960's however, the growth of computer and telecommunications equipment led to a resurgence of interest in the use of Halons as extinguishing agents. There was considerable resistance to the use of water-based systems such as sprinkler systems in these spaces; at the same time, the use of carbon dioxide was undesirable due to the human occupancy of the protected spaces. The use of Halon extinguishing agents continued grew until the middle of the 1970's when the first indications of their ozone depletion effect began to be noticed. In 1987 the Montreal Accord significantly reduced the use of most CFCs as well as compounds containing bromine. The production of Halon 1211 and 1301 was discontinued in 1994. Predictably, the cost of Halon increased. As a result, the search for alternative agents has intensified and continues today.

Water mist systems were first studied as fire suppression systems in the early 1950's. Early studies indicated that the fine particle size of these systems were more effective in absorbing heat than were the larger water droplets of standard spray sprinklers. It was also confirmed that oxygen displacement by the steam generated and the cooling effect of the water mist were dominant mechanisms of extinguishment, especially with flammable and combustible liquid pool fires.[1] Once again, the economics of this technology and the availability of alternative agents hampered its implementation: automatic sprinkler systems utilizing standard spray sprinklers, large-drop sprinklers and Halon were providing adequate and more economical protection. With the reduction in the use of Halon systems in the 1990's the use of fine water mist systems as an alternative extinguishing agent gained increased interest. These systems were the last major suppression system development in the twentieth century.[1]

This brief summary of the history and development of fire suppression components for building fire protection has merely touched upon the topic. The development of fire protection for buildings evolved with changes that occurred in the public and private sectors: changes in population from rural to urban living; changes in materials of the built environment; the industrial revolution; the growth of computing and telecommunications industry and relatively recent concerns of the environmental impact of some suppression agents, to name a few. Although great progress has been made with respect to protecting people and property, losses from fire remain a concern and much work remains. And, we can expect that other technological advances will contribute to and influence future advancements in building fire protection.

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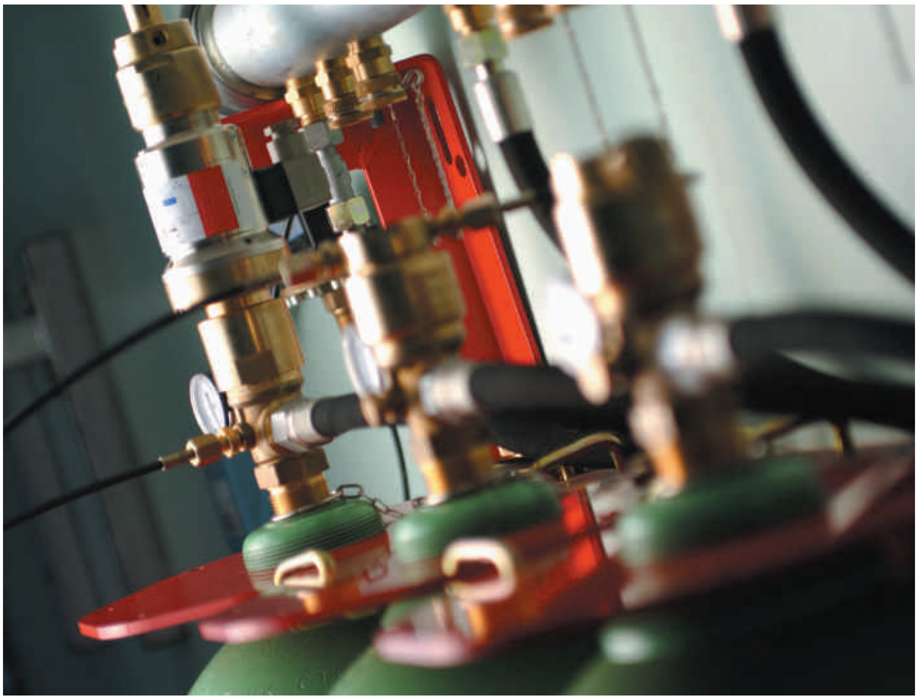
http://www.armstrongpriestley.co.uk/resources/historyOfSprinklers.htm

3. *From early inventions to modern Standards*, Barry Lee OAM, Brian Kirkby and David Michel
http://www.kirkby.homestead.com/Page05.html

Tyco's New Inert Gas Suppression System "Ticks The Boxes"



Since unveiling Hygood i3 inert gas fire suppression system for total flooding applications, Tyco Fire and Security has been inundated with interest from a wide range of market sectors, notably the telecommunications and petrochemical industries. It boasts a host of environmental credentials: it is non-toxic, non-corrosive and odour-free, as well as being zero ozone depleting and having zero global warming potential.

Designed to protect computer suites, archive stores, power generation facilities, offshore oil and gas production facilities and gas turbines, i3 has lived up to the claims that it is effective for virtually all combustible material and flammable liquid fires.

Among its many benefits, i3 is fast acting and has a low life-cycle cost; it is electrically non-conductive and has no breakdown products or residue, so there is no risk of damage to sensitive equipment, plus i3 has zero impact on the environment. Significantly, where space is at a premium, i3 has a smaller footprint than traditional lower-pressure inert gas technology. It really does "tick all the boxes".

Hygood i3 is a pure 50:50 mixture of Argon and Nitrogen and so is likely to appeal to organisations where specifying a non-chemical suppressant is of paramount importance, or where environmental concerns are high on the corporate agenda. The blended gases have a similar density to air, so the mixture retains its concentration when discharged for far longer than the now outlawed Halon 1301 chemical suppressant.

Andrew Shiner, Director of Marketing for Europe, the Middle East and Africa for Tyco Fire and Security's Fire Suppression Group, commented: "The gases used in Hygood i3 already circulate naturally in the atmosphere, so i3 neither adds to the environment nor takes anything away, and so has no detrimental environmental impact whatsoever."

It extinguishes a fire on discharge by reducing the ambient concentration level of oxygen to between 10 percent and 14 percent. This is below the concentration level necessary to support combustion, but sufficient to support life for a short period. Hence, i3 is ideal for use in occupied rooms or enclosures. Its appeal for use in occupied spaces is further enhanced by its being an invisible gas that does not obscure vision.

Hygood i3 is stored in high-pressure steel containers with an operating pressure of 300 bar. Installations comprise one or more containers connected to a system of pipe work and rapid-discharge nozzles; fully engineered solutions designed using i3 flow calculation software. Cylinders can be stored remote from the area being protected and a bank of cylinders can be used to safeguard more than a single room or enclosure.

This latest addition to Tyco Fire and Security's fire safety offering confirms the company's status as a full solutions provider. Its unveiling followed shortly after the launch of the company's Sapphire fluid-based system that uses new, sustainable, long-term technology that satisfies all of current and foreseeable regulations; a system that has an insignificant global warming potential, the lowest level of design concentration and the highest safety margin of any viable Halon 1301 or chemical alternative.

Further details on i3 can be found at www.macron-safety.com, or are obtainable by email on macron-info@tycoint.com, by telephone on +44 (0) 1493 417600, or by fax on +44 (0) 1493 417700

S.A.C.E.P.

BUREAU VERITAS
NOTIFIED BODY 1370

MARINE DIVISION

TECHNOLOGY AND SAFETY - COMPLETELY HFC

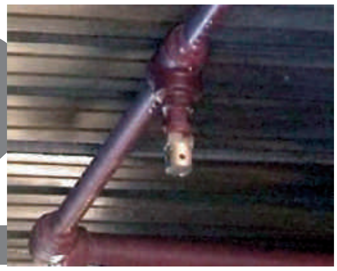
The fire-extinguishing agent **SACLON 2 ECO** is a mixture of colourless gases, that were skilfully mixed with a detossifying agent with scent of pine. The tanks are provided with rapid flux valves and the turned brass discharge nozzles are opportunely gauged for a rapid gas efflux in order to obtain the total discharge of the fire-extinguishing agent in a maximum time of 8/10 seconds. The action on fire of **SACLON 2 ECO** is to reduce in few seconds the oxigen percentage under the 14%, threshold under which fire can not survive. Thanks to its specific features it does not damage bronzes, plaster casts, pictures, clothes, tapestries and works of art, as it has no colour, no smell and it is not corrosive.
Thank to its composition, **SACLON 2 ECO** does not belong to the substances forbidden by the law nr. 549/93 and by the CEE REGULATION 3952/92, so it is actually a product considered "clean" and without limits of use or expiry. The use of the detossifying agent and the reduced discharge time lead to a rapid reduction of the environmental oxigen, with the guarantee of very rapid extinction time and restricting the damages caused by the fire they give rise to a sinergistic effect, with a reduced formation of decomposition products caused by high temperatures and allowing the evacuation of personnel in the area.

1

The pyre in pinewood, made in accordance to the UNI 10877 regulation, after being set on fire for three minutes and being let burning for three more minutes, is brought into the test-room in which there are the instruments for the survey of the data related to temperature and the percentage of oxigen in the various heights.

High pressure brass nozzles, appropriately gauged, guarantee the saturation of the environment in the maximum time of about 8/10 seconds.

2



3

The area is rapidly becoming saturated with **SACLON 2 ECO** and the fire on the wooden pyre is stiffling because of the reduction of oxigen.

The extinction took place and in the area the combustion's smokes and the extinguishing agent's rests are now circulating. The area should be abundantly aired.

4

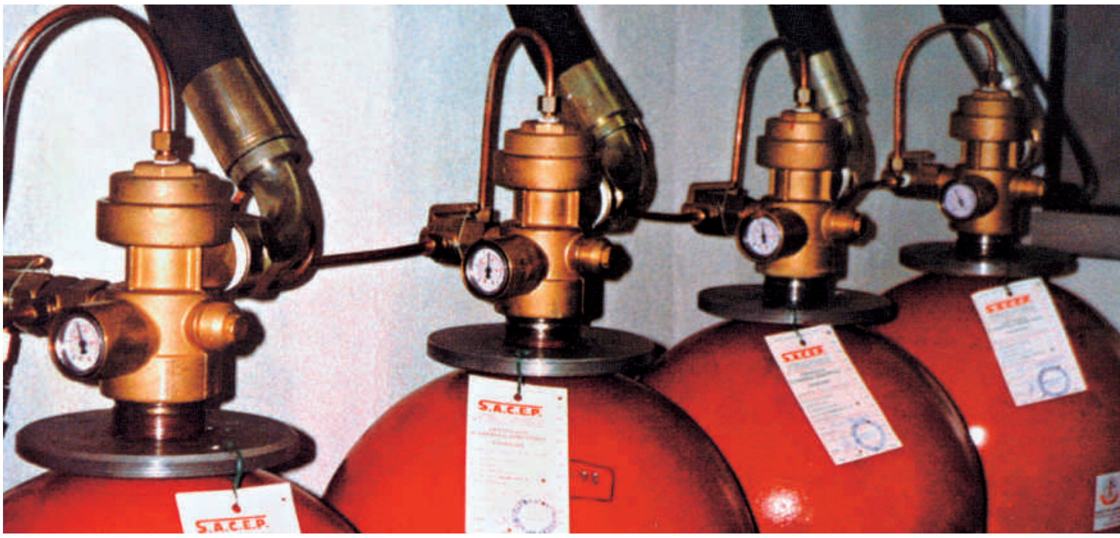
5

When the door opens you can see cleary the wooden pyre completely extinguished and without embers from the combustion.

info@sacep.it - www.sacep.it

S.A.C.E.P.

SACLON 2 ECO AUTOMATIC FIRE FIGHTING SYSTEMS



The product **SACLON 2 ECO** is a mixture obtained by chemical products absolutely ecological and not corrosive, that obtained the homologation of the **Italian Ministry of the Interior** and the preventive approval of the **Ministry of the Environment** and the **Health Institution**, whose documentation is in the archives in the **Ministry of the Interior**.
SACLON 2 ECO, for its own composition, does not have any limit of expiry or use, it does not harm the hozone and it does not belong to the range of products whose utilization is forbidden for the hozone, as it has

ODP=0 **GWP=0,26** **ALT=16**

The product belongs to the fire-extinguishing agents included in the **E.P.A. REGULATIONS** (United States Environmental Protection Agency) and **NFPA 2001**, and thanks to its particular features it is suitable for the use for portable fire-extinguishers and in trolley fire-extinguishers.
The product passed brilliantly the test by the laboratory recognized by the **Italian Ministry of the Interior** as a total flooding fire-extinguishing agent to use in fixed automatical extinguishing systems, in accordance to the **REGULATION UNI 10877/1 "GAS FIRE-EXTINGUISHING SYSTEMS"**.
The great results obtained by the product during the test, as rapidity in the reduction of the oxigen level that leads to rapidity in the extinction, both for A class (fires from solid material) and for B class (fires from liquid material), make it become a first quality fire-extinguishing agent.
The certification in accordance to the **EUROPEAN STANDARD UNI 10877/1**, that adds to the american one previously in force **NFPA 2001**, shows that the product is particularly suitable for the use in fixed fire-extinguishing systems of small, medium and big dimensions, in areas normally occupied by personnel, with the eventual limitations expected for the substitutes of Halon as total flooding agents, in centres for the elaboration of data and on apparatus under tension.

SAFETY

MAXIMUM TIME 8/10 SECONDS

ECOLOGY

NOT CORROSIVE

REGULATION UNI 10877/1

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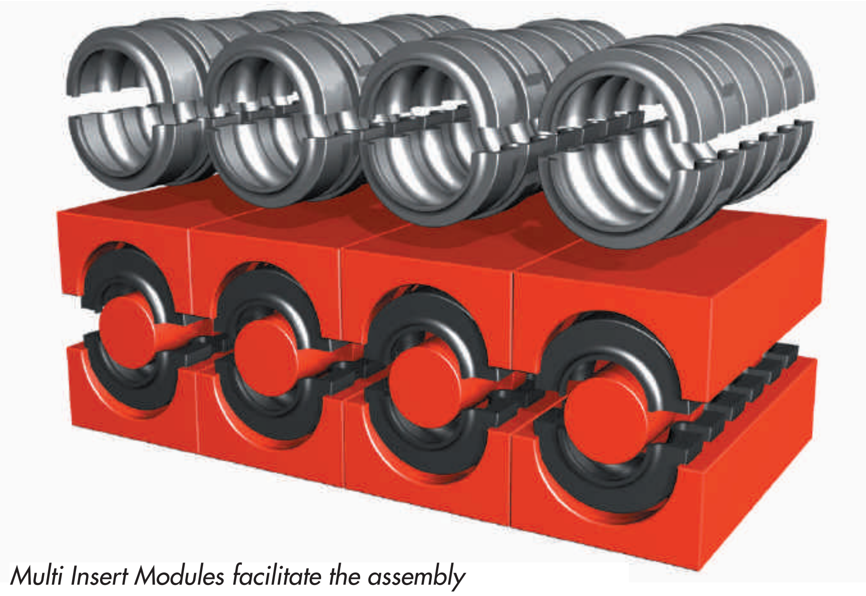
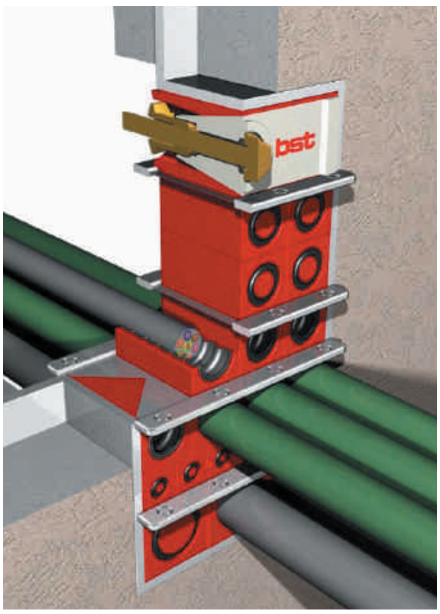


Multi Insert Modules facilitate the assembly

PREMIUM MULTI CABLE TRANSITS FROM BST-FIRESTOP.COM

Revolutionary development: Quick Fix TCM/Tolerance Cable Module

The technology of MCT's is generally known among experts as they are used wherever also watertightness, gastightness and resistance to explosion pressure are required besides the certified fire protection. For any such applications the MCT's supplied by bst-firestop.com proved their worth for decades in production plants of chemical industries, medical centers, sewage works, power plants, telecom stations, railway constructions, military units, oil rigs, ships and many other. But now there's the revolutionary development of bst's Quick Fix TCM (Tolerance Cable Module Technology). By combining "Quick Basic" with a small number of "Quick Adapters" these cable modules can be adjusted to any given cable diameter and they absorb diameter tolerances of up to 5mm by their special design. These facts as well as other details offer the below mentioned advantages to the user:



bst Multi Cable Transit with Quick Fix TCM

- Only 6 basic modules seal cables of diameters between 5 and 99mm!
- Simple planning and easy to select and order!
- Room saving storage and less weight to carry!
- Quickest and simple adaption to cable diameters!
- Flexible for future installations (all spare parts already on site)!
- All system parts are re-useable at any time!
- Simple safety check at any time!
- Multi Insert Modules and Multi Filler Blocks reduce assembly time by up to 80%!

The Quick Fix TCM technology by bst-firestop.com was subjected to various tests and is approved for a great number of applications demanding fire protection, resistance to pressure as well as resistance to ageing, high and low temperatures, chemicals, etc. By means of an elaborate and free software bst MCT's can be easily designed and documented. The application is much facilitated by the said features and assembly times are reduced by up to 80%.

This revolutionary new development made bst-firestop.com the global technology leader. **SOME LIKE IT HOT – WE DON'T!**

For more information please contact:

bst-Firestop.com

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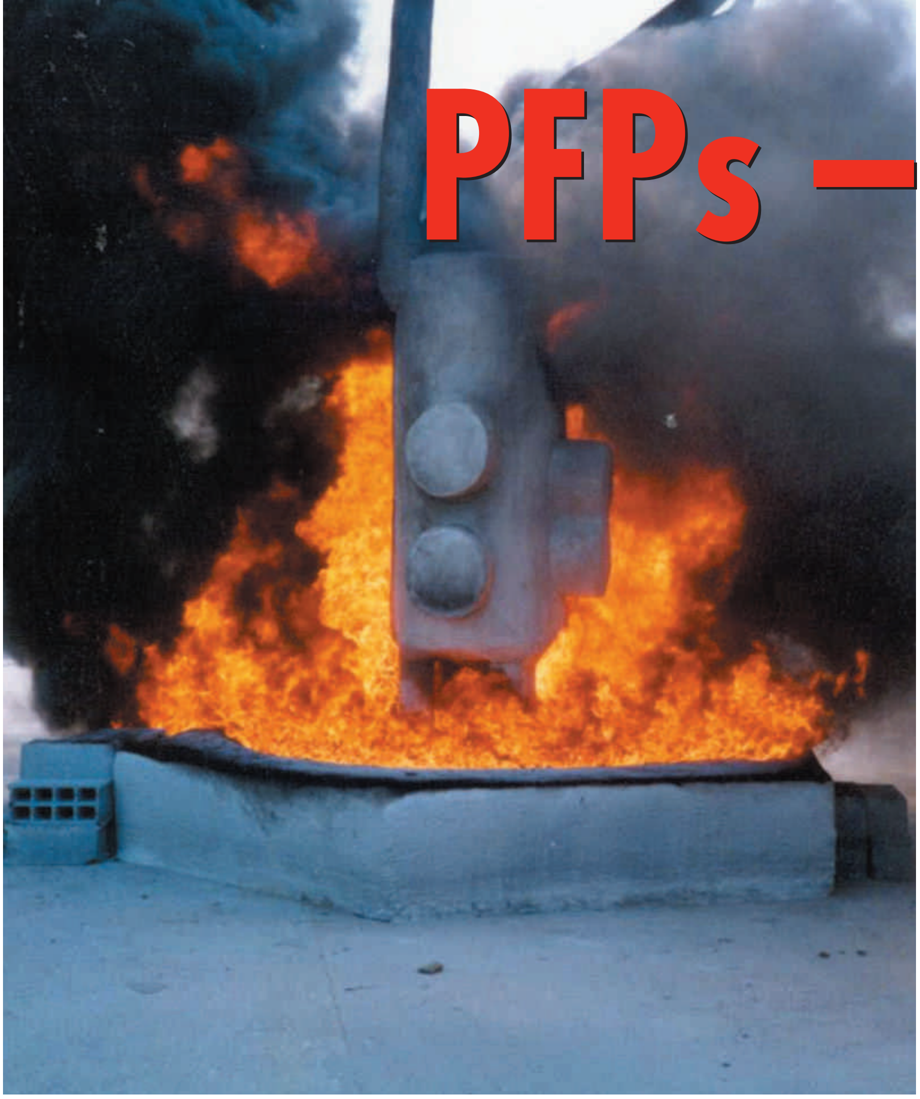
PFPs – Proven



Pic courtesy of Cafco Int.

By Mr E. Walker

CAFCO INTERNATIONAL EXPLAINS HOW costly storage tank equipment and surrounding structures can be fire protected, as well as financially protected, using a variety of passive fire protection materials.

Unfortunately, fires are not at all unusual events in high-risk installations, such as petrochemical and chemical plants. They are also usually far more severe than the more common cellulosic fires that occur in buildings. Apart from life safety, one of the most important issues that any operator must consider is the protection of the asset itself.

It is generally acknowledged that the most effective method of protecting a structure or a storage vessel against the effects of a fire is by passive means utilising coatings, cladding, or pre-formed arrangements of materials that are capable of retarding the passage of heat into a structure during fire exposure.

These passive fire protection (PFP) materials can be applied to steel and concrete equipment structures and pipe racks, as well as storage vessels and their supports, in order to maintain their stability and integrity when exposed to high intensity fires.

With onshore installations, a number of different fire scenarios can occur simultaneously and if no passive fire protection measures have been taken, the effects of a serious fire can be catastrophic. A fire might start with the ignition of a flammable substance leaking from a flange or a pump and develop rapidly as it is fed by the supply of additional fuel as the leak continues. As the temperature of a loaded steel supporting structure increases, its strength weakens to the point at which it will collapse. In the case of a pressurised storage vessel, the weakening of the vessel wall can result in a BLEVE (Boiling Liquid Expanding Vapour Explosion) as the vessel's internal pressure exceeds the strength of its weakened steel shell.

From the scenario described, it follows that any applied PFP should have the ability to perform under both POOL FIRE and JET FIRE conditions where flame temperatures can reach temperatures of 1100°C and 1500°C respectively with heat fluxes up to 350Kw/m^2.

When concrete is exposed to such fires, pressure within the matrix increases as the moisture rapidly turns into steam. When the pressure exceeds its strength, explosive spalling occurs, exposing underlying layers of concrete to the fire. As the process continues, rapid deterioration of the structure takes place, exposing the steel reinforcement. Major repairs are then often required, resulting in long shutdown periods and loss of revenue for the operator whilst the concrete is reinstated.

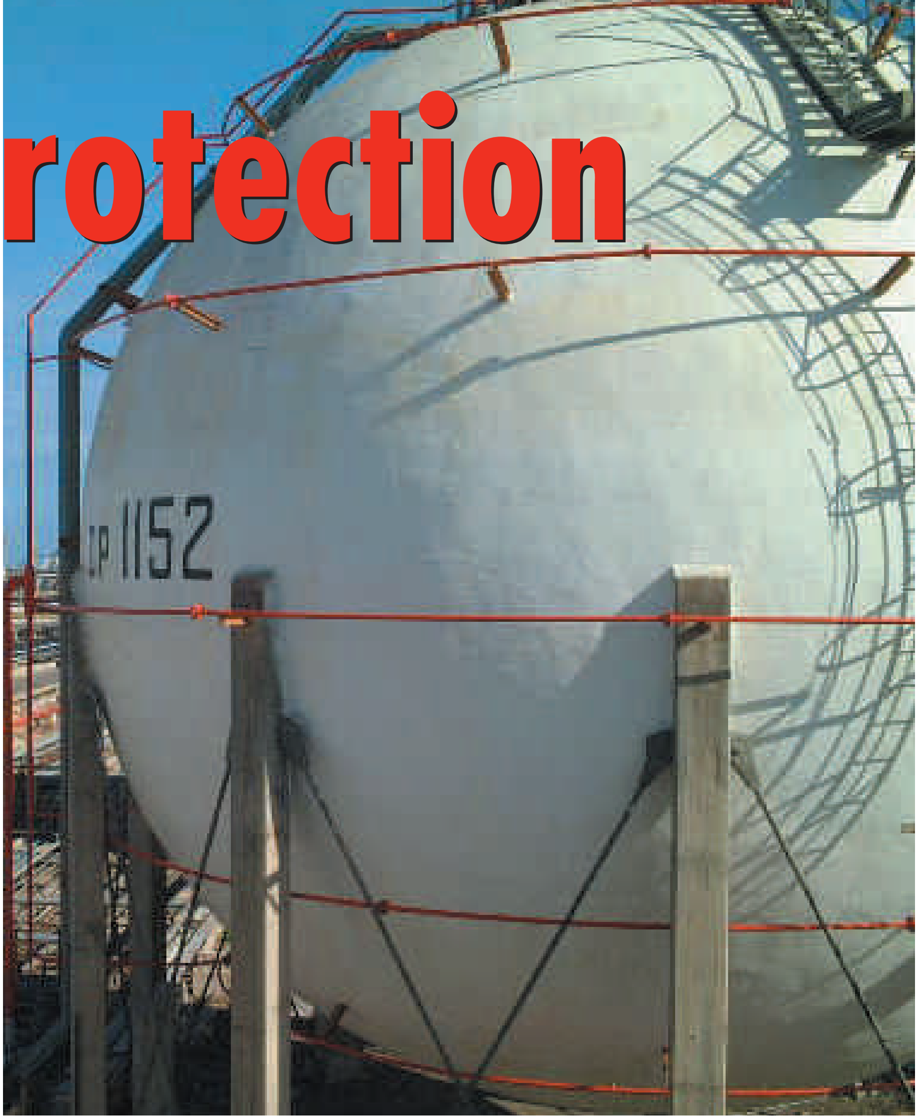
The application of a fire protective coating will limit the rise in temperature of a structure or a vessel to below its critical temperature in the event of a fire and will also prevent rapid heating of a concrete structure, reducing the risk of the spalling phenomenon.

PFP MATERIALS AND SYSTEMS

There are many types of PFP materials on the market and their performance in real fires will vary due to the way in which each material performs its fire protection function. Selection of the most suitable material must take the particular risk into account and would usually involve some, or all of the following points:

- Fire performance
- Strength
- Durability
- Low added weight
- System integrity
- Non-corrosive
- Non-hazardous
- Ease of installation
- Cost effectiveness

Asset Protection



Pic courtesy of Cafco Int.

All PFP's function by limiting the temperature of a structure, or vessel, to below its critical temperature over a specific period of fire exposure. The most common types applied in high-risk installations are:

INORGANIC COATINGS

These are the most widely used coatings with many millions of square metres applied on structures and vessels throughout the world. The materials are usually based on cement with a lightweight insulating aggregate of exfoliated vermiculite that provides exceptional dimensional stability under hydrocarbon fire exposure conditions.

The exfoliated vermiculite insulates the vessel and has the capacity to relieve the stresses created by both hot and cold thermal shock when the coating is subjected simultaneously to fire and hose stream impingement.

A major advantage of this type of coating is its ability to provide a predictable level of protection beyond this point. This was demonstrated in a major incident in a refinery complex in the UK, where the fire continued for almost seven hours with no loss of the structures or vessel supports, even though design fire rating was specified for two hours exposure.

Evidence exists to show that vermiculite cements can perform equally as well in multiple fires where no repairs or reinstatements have been carried out. This can significantly reduce plant shutdowns after minor fire incidents, with minimal loss of revenue for the operator. Many incidents have occurred in installations in the UK and throughout the world over many years.

Vermiculite cements are non-corrosive to the substrate or surfaces of a vessel and since they are non-combustible, do not produce any toxic fumes during their exposure to fire. They can therefore be used where life safety is a primary consideration. Since vermiculite cements are inorganic, they do not degrade with time and examples of structures and vessels protected more than 40 years ago still exist, with little evidence of damage or corrosion to the underlying substrate.

Vermiculite cements are non-corrosive to the substrate or surfaces of a vessel and since they are non-combustible, do not produce any toxic fumes during their exposure to fire.

The only perceived weakness of vermiculite cements is their susceptibility to mechanical damage because of their perceived low density compared to that of concrete. In fact , their strength and durability is adequate for most applications including off-site application to pre-assembled modules and single steel sections prior to their transport to site.

Cafco's vermiculite based Fendolite MII reduces the rate of temperature rise in vessels and within concrete and therefore prevents explosive spalling from occurring. It is used by a major refinery operator in the UK to protect primary concrete structures against fire.

ORGANIC COATINGS

Organic coatings are thin compared to vermiculite cements and are generally considered to be more durable as far as resistance to mechanical damage is

Pic courtesy of Cafco Int.

concerned. They fall into one of the following groups:

Intumescent mastics

Intumescents are coatings that, when subjected to fire exposure, expand to form an insulating char with a low thermal conductivity and act as a thermal barrier between the fire and the substrate. During this reaction, toxic fumes and smoke are released at temperatures above 300°C, which makes them unsuitable for use in enclosed areas such as accommodation modules and temporary safe refuges, where life safety is a major consideration.

Intumescent coatings have excellent adhesion to steel substrates and high impact resistance making them suitable for use in areas such as drilling modules and off-site applications, where regular mechanical impact is likely.

They can be prefabricated into panels to form fire rated divisions and cast onto pre-formed metal chassis in order to provide protection to equipment such as emergency shut down valves (ESDV's) and actuators, allowing the safe shut down of a plant or process during the early stages of a fire and preventing escalation of the incident.

Ablative coatings

This type of organic coating gradually erodes under fire exposure due to the absorbed heat energy input that changes the virgin solid coating into a gas composite. This action prevents heat absorption into the substrate to which it is applied.

Like intumescents they are resistant to mechanical damage, but the application procedure is complex, which contributes to relatively high application costs. The microporous char is also susceptible to damage from hose stream application during fire exposure.

Subliming compounds

The active ingredient in this type of coating absorbs heat as it changes directly from the solid to a gas phase (sublimation). As in the case of ablative coatings, intumescents are incorporated to provide an additional insulating layer.

The degree of protection provided by subliming compounds is a function of the temperature of sublimation for each particular compound, the thickness of the coating material, the heat capacity of the substrate and the degree and time of fire exposure.

SUMMARY

By their very nature, all organic coatings are consumed by the action of fire and therefore once exposed for their prescribed period, provide no further protection to the structure. This can be a major disadvantage during fires of long durations.

However, the benefits offered by the provision of adequate passive fire protection is recognised by all major operators and features in their individual Engineering and Safety Standards. All proprietary products and systems must undergo independent fire testing to acceptable Standards such as BS 476 Part 20 "Appendix" D – Hydrocarbon Curve in the UK, or UL 1709 in the USA, both of which utilise a hydrocarbon time/temperature curve representing burning hydrocarbons.

Although the various types of PFP coatings perform a similar function, selection of a suitable material should take account of the overall design requirements and it is not unusual to select a combination of different coatings and/or systems on the same installation.

Pic courtesy of Cafco Int.

We are - are you?

In the majority of EU countries, from **July 1st 2005**, The Construction Products Directive (EU - 89/106/CE) requires that fire alarm sounders must be certified as compliant to EN54-3. A specific "CE" mark and licence number on the product indicates compliance, which should not be confused with "CE" marks for other directives such as EMC.

Fulleon has invested extensively in achieving CPD Compliance for its products to ensure our customers are compliant;

Are you and your suppliers ready ?

If not we can help, call our CPD Helpline on +44 (0) 1633 628 513

Fulleon
technology

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Ameron BV Performance Coatings & Finishes Launch New Water Borne Intumesent Coating – Steelguard FM 585

Pic courtesy of Ameron BV

This October Ameron has launched the brand new water borne thin film intumescent coating Steelguard FM 585. This newly formulated product is developed for the passive fire protection of structural steel and targeted the 60 minute fire resistance market.

Steelguard FM 585 is in the real sense of the word a thin film intumescent coating. Recommended dry film thickness is in the range 0.23 mm to 0.7 mm for 3 sided exposed steel beams and 0.37 mm to 1.25 mm for 4 sided exposed columns. Fire tested to BS 476 Pt 20 and 21 and assessed for Ameron BV by the Warrington Fire Research to the ASFP Code of Practise.

Pic courtesy of Ameron BV

The good news for the Intumescent Coating Industry is that all sizes 3-sided beams can be fire protected with one coat of Steelguard FM585. This is because the product is tested on 3 sided beams is from A/V = 40 to A/V = 330.

The A/V ratio (formerly Hp/A) is the perimeter distance of the steel exposed to the fire in meters divided by the cross sectional area in meters squared. The thickness of an intumescent coating for a particular steel section size is determined by the section dimension, type and orientation.

The recommended application technique for the Steelguard FM 585 is by airless spray and its application characteristics are found to be excellent in that it has good atomisation and film forming quality. In addition to this the applied Steelguard FM 585 shows an outstanding appearance. It is very smooth and flat giving the ideal base for a highly decorative architectural finish.

The Steelguard FM 585 may be finished in a range of topcoats. These are available in all BS 4800 and RAL colours. Ameron offers water based and solvent based topcoats. Steelguard FM 585 may even be topcoated with a 2 pack polyurethane finish for additional abrasion resistance.

Ameron recommends Steelguard FM 585 for internal dry heated areas in a building, defined as a C1 environment in accordance with ISO 12944 Part 2. When fully dry, water borne intumescent coatings may be exposed to the weather for limited periods before the building is closed in but prolonged exposure to water must be avoided unless a protective topcoat is applied.

In the UK the Steel Construction Institute (SCI), Advisory Desk 269 guidance document to has to be used to calculate the thickness modification factor for cellular beams. Because Steelguard FM 585 has such low thickness for A/V = 330 at 0.7 mm on 3 sided beams the effect of the correction factors on the thickness is reduced. It is expected that the Steelguard FM 585 product will make a major contribution to the use of cellular beams in the UK construction industry.

For more information please contact:

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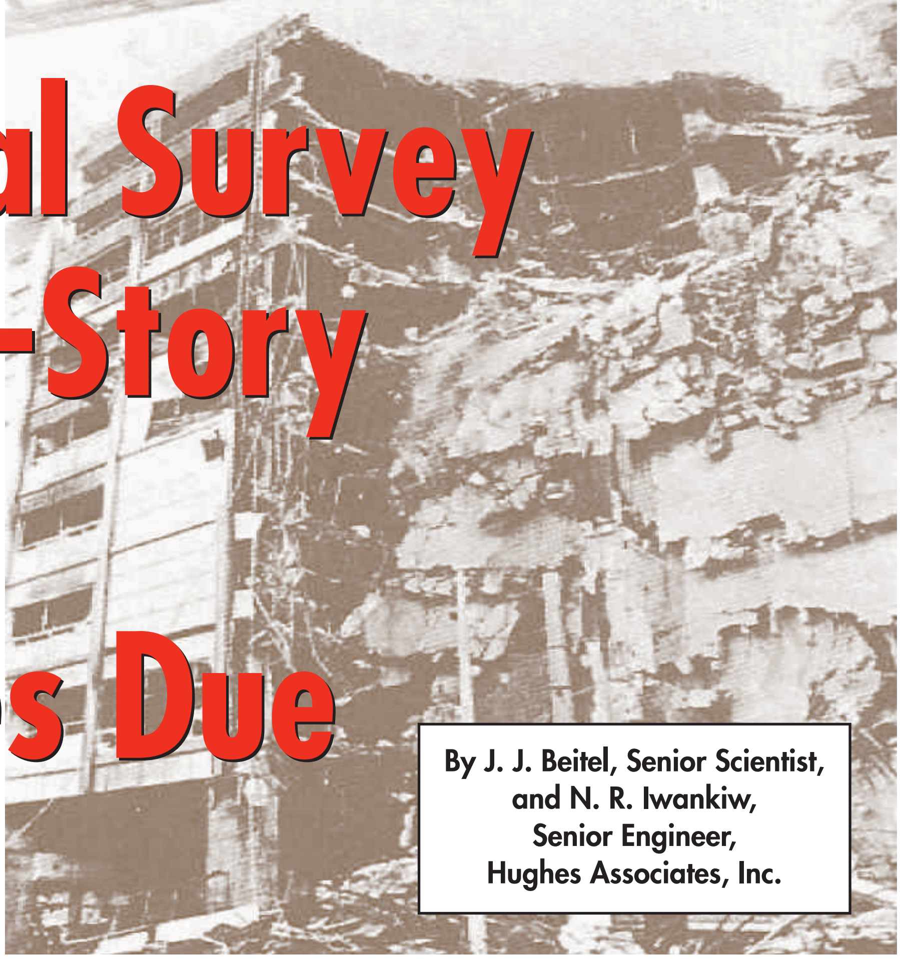
www.ameron-bv.com

Historical Survey of Multi-Story Building Collapses Due to Fire



By J. J. Beitel, Senior Scientist, and N. R. Iwankiw, Senior Engineer, Hughes Associates, Inc.

Figure 1. Katrantzos Department Building in Athens, Greece after 1980 fire

THERE HAVE BEEN, AND REMAIN, continuing concerns about the adequacy of structural fire protection in the wake of the 9/11 tragedies. As significant as these events were, they were also clearly not representative of the normal accidental impact of fire on building structures. To assess the extent and nature of structural collapses due to fire in taller buildings, a review of existing information about fire incidents resulting in structural collapse was collected and reviewed.

The survey was international in scope, and included building collapses due to fire in structures with four, or more, stories that had occurred between 1970 and the 2002 time frame of the survey. Both total and partial collapses were included in the survey. Since no database exists that systematically identifies building collapses due to fire (including the NFIRS system), the survey was necessarily exploratory. The survey methodology included a review of both news sources and the technical literature, as well as interviews with a wide range of individuals knowledgeable in structural fire protection. A total of 22 fires were identified that caused either partial or total collapse of a multi-story structure. The adequacy and code compliance of the original structural and fire resistant design of the identified buildings was beyond the scope of the project, and was not assessed. While this total number of fire events may appear low (average of one/year), these fire events are high consequence occurrences with respect to potential for loss of life, injuries and economic costs.

This survey of structural building collapses due to fire causes was sponsored in 2002 by the National Institute of Standards and Technology (NIST) as part of a larger project under the direction of its Program Manager, William Grosshandler. The complete Iwankiw and Beitel, (2002) report is available from NIST.

SURVEY RESULTS

For the purposes of this NIST survey, multi-story buildings were defined as those having four or more stories. Non-building structures, such as tunnels, bridges, observation or transmission towers, were not included. Either partial or total failure of the structural framing, members, and/or connections was considered to have constituted a collapse, and it was necessary for a fire to have been the direct cause of this failure.

Either partial or total failure of the structural framing, members, and/or connections was considered to have constituted a collapse, and it was necessary for a fire to have been the direct cause of this failure.

Historical Survey of Multi-Story Building Collapses Due to Fire

A total of 22 such cases were identified through 2002 after extensive searches of the literature, News, and other contacts, with the Sept. 11th disasters in New York and Washington, DC counting as 5 of these incidents (World Trade Center (WTC) 1, 2, 5 and 7, and the Pentagon). The cases had occurred not just in the US and North America, but also internationally. This NIST survey data demonstrated that buildings of all types of construction and occupancies, in the US, North America, and abroad, are susceptible to fires, particularly older buildings and those that may be undergoing construction, renovations or repairs. The total enormous fatalities were dominated by the Sept. 11th WTC disasters, which were unique in that they were precipitated by terrorist attacks that substantially damaged the buildings' structural framing and destroyed its fire protection systems prior to the fires.

The NIST survey of 22 fire-induced building collapses from 1970-2002 identified a variety of conditions, materials, locations, and buildings. Fifteen cases were from the US, two from Canada, and five from Europe, Russia and South America. The numbers of fire collapse events can be categorized by building material as follows:

- Concrete: 7 (1 in Pentagon 9-11 event)
- Structural steel: 6 (4 in 9-11 WTC events)
- Brick/masonry: 5
- Unknown: 2
- Wood: 2

Three of the these events were from the 1970's, another 3 from the 1980's, four from the 1990's, and twelve for 2000 and beyond. This temporal distribution is skewed towards more recent occurrences, as expected, both due to the magnitude of the WTC (counted as 4 events) and Pentagon (1 event) disasters of 9-11 and the news media searches.

The collapse distribution by building story height was as follows:

- 4-8 stories: 13
- 9-20: 3
- 21 or more: 6

Almost 60% of the cases are in the 4-8 stories range, with the remainder affecting much taller buildings. Six collapses occurred in buildings over 20 stories, and 3 of these were the WTC steel-framed buildings (1,2 and 7).

At least four of these fire collapses had occurred during construction or renovations of some kind, when the usual expected architectural, structural and fire protection functions were still incomplete or temporarily disrupted, and/or potential new fire sources were introduced, such as electrical and gas line repairs, welding, and the presence of other flammable supplies and/or equipment. Partial collapses (14 events) were the most frequent occurrences, and the WTC disasters (listed as 4 separate events, with 3 full collapses) dominated the full collapse event total of 8 cases. Office and residential were the primary types of occupancy in these 22 buildings, as would be expected in multi-story construction, with the occupancy distribution being as follows:

- Office: 9
- Residential: 8
- Commercial: 3
- Combined commercial/residential: 2

The 9-11 events are quite thoroughly documented in the FEMA 403, (2002) and ASCE-SEI Pentagon (2003) Reports, with further NIST investigations on the WTC ongoing, and will not be further covered herein. Rather, some other interesting and more obscure cases of fire-induced collapses will be described.

Two large department store fires in Athens, Greece in 1980 are documented in the paper by Papaioannoa, Kyriakos, 1986. These fires began at 3 am on Dec. 19, 1980, with arson being suspected as the cause. The Katrantzos

Figure 2. CESP 2 Core Collapse in Sao Paulo, Brazil

The cause of these failures was considered to be restraint of the differential thermal expansion of the structure that overloaded its specific elements or connections.

Sport Department Store was an 8-story reinforced concrete building. Its fire started at the 7th floor and rapidly spread throughout the building, due to lack of vertical or horizontal compartmentation and the absence of sprinklers. Collected evidence indicated that the fire temperatures reached 1000°C over the 2-3 hour fire duration, and the firefighters concentrated on containing the fire spread to the adjacent buildings. Upon termination of these fires, it was discovered that a major part of the 5-8 th floors had collapsed. Various other floor and column failures throughout the Katrantzos Building were also observed, see Figure 1. The cause of these failures was considered to be restraint of the differential thermal expansion of the structure that overloaded its specific elements or connections.

On May 21, 1987, Sao Paulo had one of the biggest fires in Brazil, which precipitated a substantial partial collapse of the central core of the tall CESP Building 2. (Berto, Antonio Fernando and Tomina, Jose Carlos, 1988) This was a 21-story office building, headquarters of the Sao Paulo Power Company (CESP), after whom the building was named. Buildings 1 and 2 of this office complex were both of reinforced concrete framing, with ribbed slab floors. According to this Berto and Tomina (1988) paper, these two buildings had several unique internal features and contents. Both buildings still retained their original wood forms used for pouring the concrete floor slabs, which were never removed. Low-height plywood partition walls were also used in the interiors. Approximately two hours after the beginning of the fire in CESP 2, its structural core area throughout the full building height collapsed. This collapse was attributed to the thermal expansion of the horizontal concrete T-beam frames under the elevated fire temperatures, which led to the fracture of the vertical framing elements and their connections in the middle of the building, and the consequent progressive loss of gravity load-carrying capacity. (see Figure 2)

A fire-initiated full collapse of a textile factory occurred in Alexandria, Egypt on July 19, 2000 (BBC News, 2000). This 6-story building was built of reinforced concrete, and its fire started at about 9 am in the storage room at the ground floor. Fire extinguishers were non-functional, and the fire spread quickly before the firefighters could arrive. An electrical short-circuit accelerated the fire spread. At about 6 pm, 9 hours after the start of the fire, when the blaze seemingly was under control and subsiding, the building suddenly collapsed, killing 27 people. Figure 3 shows a photograph of this collapse.

Figure 3. Collapsed Textile Factory in Alexandria, Egypt

floors. Many of the past major fires in tall buildings fortunately occurred in the evenings or weekends, when the office buildings were almost vacant, hence, minimizing their potential dangers to human life. Automatic sprinkler systems are a very effective means to suppress a fire, but if the system is being repaired, or is non-existent or non-functional for other reasons, the threat of fire growth increases.

Another important finding of this study was the lack of readily available, and well-documented, information on partial or total structural collapse due to fire. Unless the fire event was significant for other reasons, i.e., loss of life, very little information was available. It is recommended that a centralized database be developed, whereby structural damage and collapse can be investigated and systematically reported in the future. The current lack of systematic information on fire-induced collapses seriously limits the profession's understanding of the scope and nature of the real structural fire protection problem.

CONCLUSIONS

Past experience and this 2002 NIST collapse survey confirm that fires, and the related damage, deaths, casualties and any collapses are essentially rare and random events, whose effects depend highly on the time, nature and circumstances of the fire occurrence. Thus, fires represent a hazard to all building types, materials, and occupancies. Likewise, the added fire-fighting difficulty in all taller buildings must be recognized, given the longer times needed to escape or access the higher

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E. J. BOWMAN LTD.

The importance of heat exchangers in diesel engine driven fire pumps

Heat exchangers are an important component in diesel engine driven fire pump systems. They are used to cool the fire pump engine water and are a superior alternative to an air cooled system.

Heat exchangers have two fluid circuits – one of a hot and one of a cooler fluid. The cooler fluid cools the hotter fluid by heat transfer through the metal tubes inside the heat exchanger. In a fire pump engine the mains water supply flows through the tubes in the heat exchanger and cools the engine water that flows over the tubes.

It is important to cool the engine water to prevent the engine from overheating which could result in failure of the fire pump engine. An air cooled system using a radiator would not be able to achieve the cooling capabilities of the heat exchanger as fire pumps are often located in a small room where there is a lack of air flow and the air may be hot due to a fire. Therefore the air would not be able to cool the engine water sufficiently.

Bowman, a manufacturer of heat exchangers for a variety of industries since 1919, has recently found that the fire pump market has been a growing market for its heat exchangers. 'Traditionally the main markets for our heat exchangers have been the hydraulic, marine and power industries but increasingly fire pumps are of growing importance for us' said Roger Bowman, the managing director. 'Our units are popular due to the combined heat exchanger and header tank which makes installation easy and removes the need to buy a separate header tank. Due to this design and the excellent product quality we are now selling heat exchangers to several fire pump manufacturers in UK, Europe and further afield'. Bowman manufactures a large range of header tank heat exchangers suitable for engines from 40kW (54HP) to 1400kW (1876HP).

'Our units are popular due to the combined heat exchanger and header tank which makes installation easy and removes the need to buy a separate header tank. Due to this design and the excellent product quality we are now selling heat exchangers to several fire pump manufacturers in UK, Europe and further afield.'

For more information please contact:

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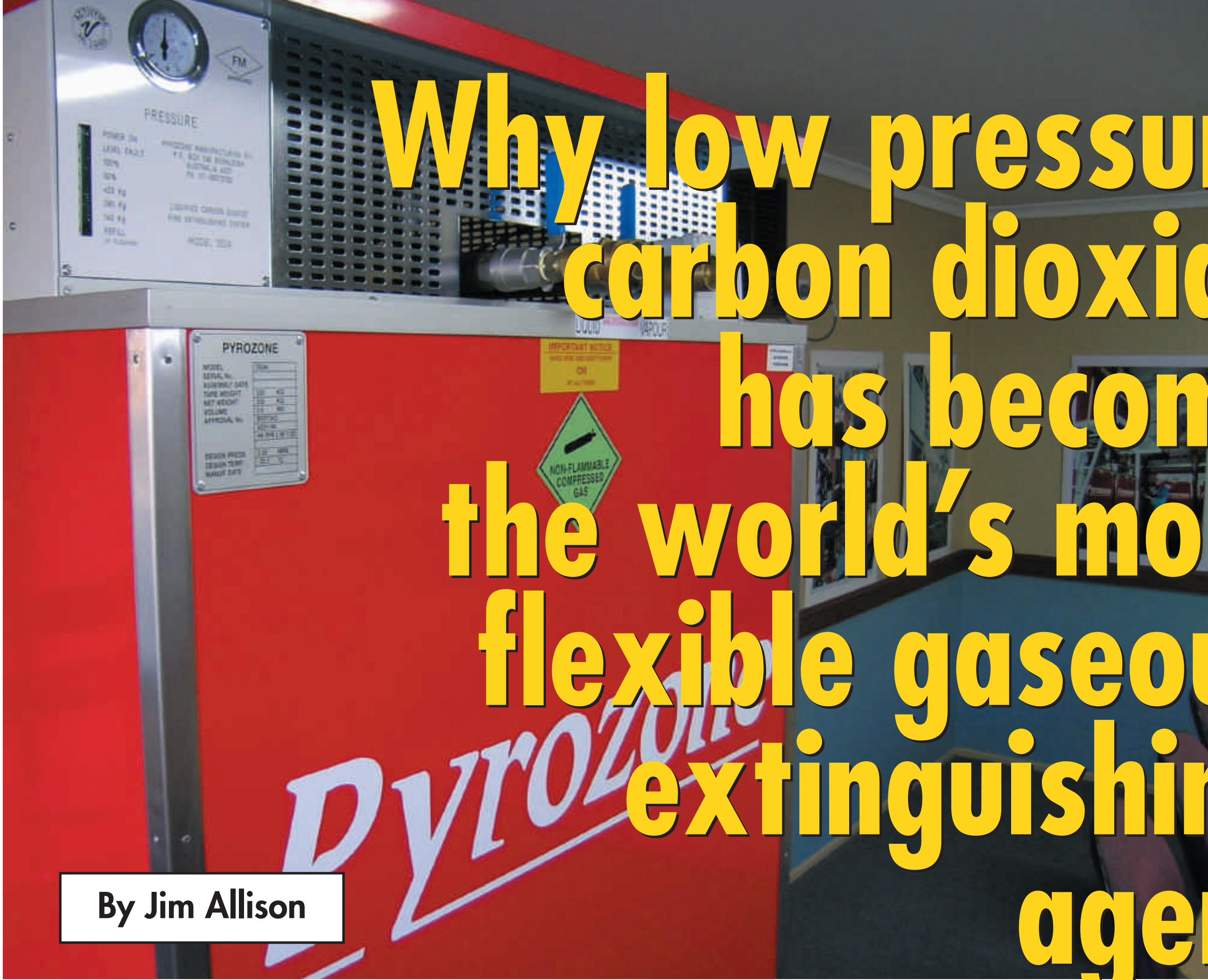
Website: www.ejbowman.co.uk

Why low pressure carbon dioxide has become the world's most flexible gaseous extinguishing agent

By Jim Allison



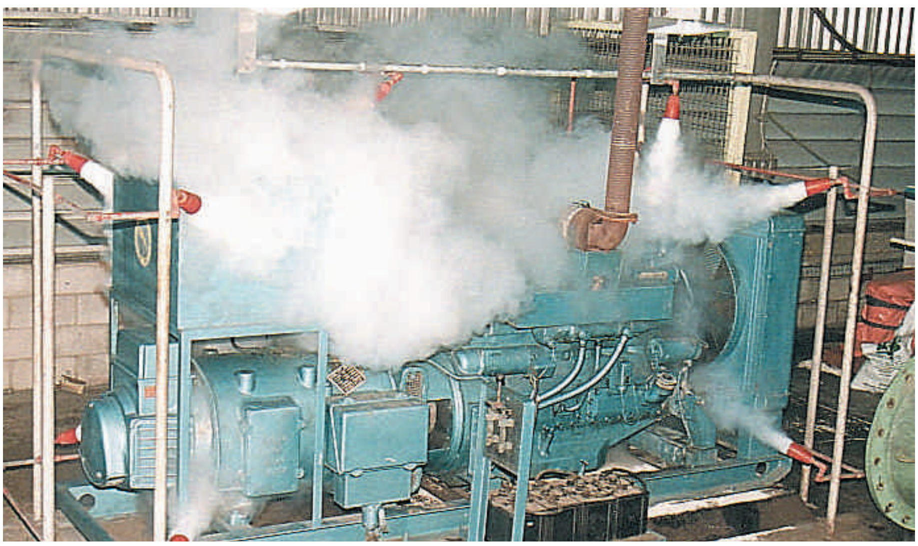
Pic courtesy of Pyrozone

THE TERM "LOW PRESSURE" may seem a misnomer because low pressure containers are still about 20 times atmospheric pressure, or about 10 times the pressure in your car tires. It is low however, compared to the pressure of a quantity of carbon dioxide in a cylinder allowed to be at whatever pressure it wants and it turns out that cylinder pressure is in proportion to ambient temperature. Such cylinders are known as "high pressure" cylinders. To achieve "low pressure" storage the containers are refrigerated since the lower the temperature, the lower the pressure. It has been common practice with low pressure containers to hold the carbon dioxide at about minus 18°C. This lower pressure allows thinner walled containers.

Carbon Dioxide is the world's most used industrial gas with uses ranging from food preservation to fire protection. Interestingly, in a recent breakthrough it shows promise as a benign solvent in replacing volatile organic solvents such as chlorinated hydrocarbons and chlorofluorocarbons in the manufacture of pharmaceuticals. High pressure carbon dioxide cylinders contain typically, in fire protection use, no more than 45kg but its thousands of uses around the globe require storage en-mass, customarily in its low pressure form. The largest of these bulk storage containers can contain over 200,000kg.

LOW PRESSURE BULK SYSTEMS

With the advent of carbon dioxide usage in fire protection in the 1920s, the Kidde high pressure cylinder became the benchmark mode of storage. Although a standard 100lb cylinder can protect a maximum volume of 50.4m^2 the economical Kidde cylinder of the day made manifolded cylinder banks cost effective thus protecting larger volumes. Also, being relatively small the



Pic courtesy of Pyrozone

Pic courtesy of Pyrozone

cylinders are very flexible in locating within a building.

A natural progression to bulk tanks was inevitable however, when it came to protecting multiple risks requiring multiple tonnes of extinguishing agent. A single tank was used with sufficient carbon dioxide to protect all risks with a reserve supply as well, if necessary. A multi-branched pipe work system extended from the tank to each protected area with a directional valve to control the flow along each branch.

SPECIFIC BENEFITS OF LOW PRESSURE BULK SYSTEMS

The benefits have proved to be numerous.

- 28% less carbon dioxide is needed in Local Application systems. Low pressure storage contains a higher percentage in liquid form, which is required for this specialized application.
- The low pressure tank can be refilled in-situ whereas cylinders need to be disconnected and removed, then reinstalled after filling.
- The labour involved in installing manifolded cylinder banks is obviated and the maintenance of a single bulk tank versus a large bank of manifolded high pressure cylinders is substantially reduced
- Equivalent low pressure storage can require only half the floor area because the storage geometry is more efficient and the density of low pressure carbon dioxide is greater.

EMERGENCE OF MINI-BULK

The hole discovered in the Ozone Layer and the ensuing Montreal Protocol were the harbinger of a new paradigm in gaseous fire protection. The demise of the extinguishing agent Halon, in its forms of the day, was imminent. All the cards were up in the air. One thing was clear. There would be a resurgence in the use of carbon dioxide.

Pic courtesy of Pyrozone

While international efforts were focused on finding a magical chemical that could do what Halon did, two companies redefined carbon dioxide. Ansul Preferred, from the US and Pyrozone Manufacturing P/L from Australia introduced the "Mini-bulk" concept to the market in the early 1990s. Patent application dates would suggest that Pyrozone was the first with this innovative approach.

Mini-bulk systems are based on low pressure carbon dioxide storage and provide modular ranges in capacities of about 155kg to 700kg. Mini-bulk tanks are manifolded together to provide the necessary capacity whereas the traditional bulk tank is selected with capacity to do the job (you need 48,500kg here's a 50,000kg tank).

PHILOSOPHICALLY DIFFERENT TO "TRADITIONAL SYSTEMS"

The **traditional bulk tank**'s strength is:

- On-site refilling
- Easily protect many areas

It's weakness:

- Limited flexibility with positioning

The **traditional high pressure cylinder**'s strength is:

- High flexibility with moving and locating in a building

It's weakness:

- Unwieldy in large numbers
- Service intensive
- Contents monitoring costly

The highly innovative mini-bulk concept combines the benefits of these two traditional storage methods without their weaknesses. To this, the Australian Pyrozone technology has incorporated electronic contents monitoring, adding no extra cost to a standard unit and providing 24/7 surveillance (read: "peace of mind") that sufficient agent is present to do the job.

A SPECIFIC BENEFIT IN HALON REPLACEMENT

Low pressure carbon dioxide has the lowest operating pressure of any gaseous extinguishing agent. Apart

from reducing leak potential it provides a specific benefit in the ability to reuse existing halon pipe work in a retrofit situation. The 10 second discharge required for halon compared to the longer carbon dioxide discharge usually means there is sufficient pipe work capacity in a changeover to carbon dioxide. This is not the case for most 10 sec discharge agents. For the End User this results in less business disruption and much lower costs.

A UNIQUE ABILITY

If you are protecting many risks through directional valves from a central bank then it will often **not** be necessary to have in storage the sum of all risks' requirements. This can reduce costs significantly. It can still be possible however for each risk to have reserve protection on-line. Low pressure carbon dioxide provides unprecedented flexibility to do this, even with widely varying risk sizes, through a "timed discharge" facility. This is unavailable with any other gaseous extinguishing agent, even high pressure carbon dioxide!

This flexibility can be capitalized upon further by incorporating into the carbon dioxide central storage bank, the protection of risks whose location puts them beyond the reach of other systems.

DISTANCE

The protection of distant risks has to be approached with great care. "Anyone who has attempted it will be aware that the smaller the risk, the closer it needs to be to the storage bank". An inherent difficulty where highly compressible fluids are rapidly discharged is freezing of fluid within the discharge lines. There are also basic requirements such as design concentration and rate-of-discharge specified in Fire Protection Standards that need to be achieved. The time delay between opening the valves and when liquid carbon dioxide starts to flow from the nozzles in the protected area is a factor in this.

The greatest distance to a risk known to have been achieved by a low pressure carbon dioxide system, and still meeting rate-of-discharge requirements, is 450m. The protected area of over 4,500m^2 was classed a deep-seated electrical risk. The ability to do this meant that all 12 risks within the building were able to be protected from a central bank, enabling great savings to be made with no compromise in protection.

The design of such a system required thermodynamic modeling to ensure there was enough energy in the carbon dioxide and the steel encasing it to prevent too great a pressure drop. An innovative technique was employed in the discharge. Valves were opened allowing the carbon dioxide to flow out, fill the pipe and commence to discharge into the protected area. At this point other mini-bulk units still at full pressure were opened, thus boosting pressure in the pipe and helping sustain the discharge. At the end of the discharge the pipe work was examined and no freezing of the carbon dioxide had occurred.

CO_2 storage from Pyrozone

Pic courtesy of Pyrozone

FUTURE

Mini-bulk low pressure carbon dioxide has redefined traditional high and low pressure carbon dioxide systems. It continues to stretch the boundaries with capabilities beyond any other gaseous agent. Used judiciously and carefully it will continue to save lives and livelihoods.

Fire Safety Guidance f – Consultation D

IN LATE JULY, THE Office of the Deputy Prime Minister (ODPM) issued the consultation documents for Approved Document B – Fire Safety, with a closing date for comment of 18 November 2005. Approved Document B provides practical guidance on meeting the requirements of the Building Regulations for England and Wales. The consultation documents are available from the ODPM website (www.odpm.gov.uk) under the Consultation Papers section.

By Graham Ellicott, Chief Executive, Association for Specialist Fire Protection (ASFP)

The first major change that hits the reader of the document is that Approved Document B has been split into two proposed volumes, namely 'Dwellings' and 'Buildings other than Dwellings'. This change was intended to make the guidance more accessible for smaller firms that specialise in domestic work. Due to the amount of technical information that is common to both, however, neither volume is particularly small.

On opening either volume the reader will notice that the proposed changes and the reasoning behind them have been highlighted by the use of a different colour for amended text and for strikeout, where the change is a deletion. Text boxes have been used to identify the reasoning behind significant changes.

The Government is proposing to introduce a new general Regulation into the Building Regulations, which will apply to non-domestic properties. This will require that sufficient information should be provided for persons to operate, maintain and use the building in relative safety before a completion certificate can be issued. In practice, this is likely to mean that the Building Control Body will need to satisfy themselves that the developer has passed on relevant fire safety information to the owner/user of the building. The Government sees this as particularly important given the increasing use of building designs which rely, at least in part, on fire safety management strategies. This change should result in potential cost savings as the drawing together of this information at the construction stage should reduce future costs of sourcing and assessing this information at a later date. It should also assist owners/occupiers in the production of their risk assessment under the terms of the Regulatory Reform (Fire safety) Order, which is expected to come into force around 1 April 2006.

The Government does not propose to make any changes to the requirements of Part B of Schedule 1 to the Building Regulations 2000. However, the consultation document questionnaire asks whether readers wish to revise functional requirement B3 (Internal Fire Spread (Structure)) or to introduce a new requirement B6, so as to address more explicitly the issue of fixed fire-fighting equipment (e.g. sprinklers).

The proposed changes to the guidance in Approved Document B fall into four main categories:

- Responses to changes in construction practice or to fire experiences that indicate that present guidance may not give sufficient protection
- Updating to take account of changes to British Standards and other technical references (such as the recent publication of BS 9251 on residential sprinklers)
- Updating to take account of changes to associated legislation
- Deregulatory measures that clarify an area that experience has shown is subject to misunderstanding, or to lessen a particular provision in the existing guidance that is now considered to be onerous.

The most significant changes the Government intends to make include:

- Amend the provisions for smoke ventilation of common access areas in apartment buildings
- Provide for an additional smoke alarm in apartment buildings and dwelling houses
- Provide for a suitable system of smoke alarms where a domestic extension is proposed

> *The Government is proposing to introduce a new general Regulation into the Building Regulations, which will apply to non-domestic properties.*

or England and Wales ocuments Issued

- Provide for cavity barriers in dwellings and non-dwellings
- Introduce provisions for measures on inclusive design
- Introduce a national maximum unsprinklered compartment size for warehouses (and potentially repeal the relevant parts of Local Acts)
- Design compartment walls to take account of deflections during a fire.

In addition, the Government is minded to introduce the following provisions, but is explicitly seeking further information on the potential impacts, particularly the costs and benefits of these proposals, before deciding on the way forward:

- Provide for sprinkler protection in high rise apartments and residential care homes
- Provide for fire protection of corridors in, typically 'self-storage', warehouses
- Amend provisions for firefighting shafts
- Provide additional dry rising mains in certain tall buildings
- Discounting stairs in tall buildings with phased evacuation procedures
- Remove the separate guidance on loft conversions in dwelling houses
- Remove provision for self-closing devices within apartments and dwelling houses (except doors into garages and those opening onto common escape routes).

It is proposed that Approved Document B will, in future, cross-refer to the Department for Education and Skills document "BB100 Designing and Managing Against the Risk of Fires in Schools".

It is proposed that Approved Document B will, in future, cross-refer to the Department for Education and Skills document "BB100 Designing and Managing Against the Risk of Fires in Schools". This was issued for consultation on 1 August 2005 with a closing date for comments of 31 October 2005.

In the Approved Document B consultation documents there are a number of proposed amendments which will provide alternatives to existing provisions. For example, the potential to provide sprinkler protection instead of an alternative escape route where currently provided in both houses (typically 4 storeys and above) and multi-storey apartments. These new options are claimed to provide greater design freedom and thus will promote innovation and may, in some cases, produce a cost saving compared to current guidance.

The Association for Specialist Fire Protection (ASFP) was especially encouraged to see the following proposed wording in the consultation document with regard to third party accreditation schemes for the installation of fire protection systems:

'Schemes such as those mentioned above may be accepted by Building Control Bodies as evidence of compliance. The Building Control Body will, however, wish to establish, in advance of the work that the scheme is adequate for the purposes of the Building Regulations.'

The ASFP was also heartened to see that its publications *'Ensuring Best Practice for Passive Fire Protection in Buildings'* and *'Fire Stopping and Penetrations Seals for the Construction Industry'* have been newly referenced in the consultation documents, thus joining "Fire Protection for Structural Steel in Buildings" which has been included in Approved Document B for a number of years. All ASFP publications are freely available as downloads from its website, www.asfp.org.uk

In the Approved Document B consultation documents there are a number of proposed amendments which will provide alternatives to existing provisions.

BOSCH EXTENDS REACH OF PRAESIDEO P/A SYSTEM WITH NEW CAT-5-CONNECTED CALL STATION

- Call station connection over standard CAT-5 cabling
- Complete fail-safe supervision and IEC60849-compliant

Bosch Security Systems is enhancing its acclaimed Praesideo Public Address and Emergency Evacuation System with a new Remote Call Station and Call Station Interface that use CAT-5 (Category 5) cabling.

The use of CAT-5 cabling, the industry standard for data communications in computer and IP networks, gives the Praesideo system even more flexibility in system design. The new Remote Call Stations can be located up to one kilometer away from the Call Station Interface. Other advantages of using CAT-5 cabling are that it does not add to the Praesideo's system bus length and it makes call station installation easier.

The new Remote Call Station – the LBB4438/00 – can be powered either by the Call Station Interface or from a local power supply if a large number of keypads are to be used at long distance. The LBB4438/00 can be extended with up to 16 keypads each with eight configurable keys. The Call Station Interface is also new and is specially designed to accept the CAT-5 digital audio and control data connection with the Remote Call Station, and to connect to the Praesideo's optical fiber network. Both the LBB4438/00 Remote Call Station and the LBB4437/00 Call Station Interface are fully supervised and comply with IEC60849, the European standard for voice alarm systems. A new Remote Call Station Kit – the LBB4439/00 – will also become available.

The LBB4438/00 otherwise has the same functionality as the existing Basic Call Station. Among key features are support of fail-safe mode, high-quality digital audio and the fact that it is configurable via the Praesideo network controller through a web browser interface.

Bosch's Praesideo is one of the most advanced and comprehensive public address and emergency evacuation systems available. It is IEC60849 certified by the independent and internationally recognised TUV Product Service GmbH testing authority in Germany. Praesideo uses an optical fiber network configuration that allows optimal freedom in system design. This flexible system architecture permits any type of equipment to be located wherever required in a building. In addition, multiple systems can be easily connected and controlled over TCP/IP using optical or standard UTP copper cabling. Distributed signal processing enables the central system unit – the network controller – to concentrate on functions such as supervision, routing announcements, background music and pre-recorded messages.

The addition of the new Remote Call Station, interface and call Station Kit to the Praesideo system fulfils the requirement for public address and emergency evacuation installations in medium to large buildings or complexes where multiple call stations need to be located at some distance from the main system.

See www.boschsecurity.com for further information.

For further information, please contact:
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Email: raymond.weijts@nl.bosch.com

D-TEC'S VSD INSTALLED IN OMAN AIRCRAFT HANGAR

D-Tec has supplied Oman's Royal Hangar at Seeb International Airport with a VSD [Video Smoke Detection] system comprising 16 low light CCD cameras. The airport was planning to install flame and linear heat cables in the 210-metre by 110-metre by 27-metre high hangar until it learned of VSD's accuracy and fast response.

Built to house A380 Airbus' and Boeing 747's, the hangar has been specially designed to have no internal support columns. Discussions about the best way to protect the building from fire went on for some time, however, after a presentation from BSS-ME, D-Tec's Middle East distributor, VSD was judged to be the best choice. In 20 tests it detected smoke that appeared above the planes' wings within 90 seconds, proving that it does not wait for smoke to rise to the roof, as is the case with most smoke recognition and heat detection systems.

Malcolm Gatenby of BSS-ME said: "We are extremely pleased that the airport chose to protect the hangar with VSD, as the cameras, which monitor an area of 80 metres in length at an angle of 40 degrees, successfully identify smoke quicker than any other type of detector previously considered."

Seeb International Airport is the largest of the six in the Sultanate of Oman and annually carries 2.4 million passengers to 66 destinations worldwide. Located 30 kilometres outside of the capital city of Muscat, the airport is currently being enlarged and improved.

Further details on D-Tec and VSD, which was awarded The Queen's Award for Innovation in 2003, can be found at www.dtec-fire.com. Copies of the company's sales literature are available on +44 (0) 870 458 1517, by fax on +44 (0) 870 458 1518, or via email at sales@dtec-fire.com

ONE STOP SHOP FOR FIRE ALARM ACCESSORIES

This month **Cranford Controls** are launching a new 12v sounder strobes and beacons to compliment their existing 24v range. These will allow users to maintain a consistent image throughout both their fire and security systems.

The new low-current Vantage Combi sounder beacons offer excellent performance in terms of light output for a very reasonable operating current, and are the ideal solution in situations where the DDA calls for additional visual indication.

The Vantage, COMBI and VXB Beacon ranges, all have universal mounting bases and are fully lockable to comply with the latest requirements of BS5839 and EN-54. The Vantage sounder range is also available with full EN54-3 and CPD approval in both red and white casings.

Brand new to their product portfolio is the CPT series of Call-Points and accessories. These call points are designed to be EN54-11 compliant and each unit can be used with either a break glass or re-settable element.

They are now also able to offer the IS range of intrinsically

safe sounders, strobes & sounder strobes which give exceptional performance for a very reasonable cost. Together with approved barriers and enclosures, as well as flameproof range of sounders & strobes, offering a full solution for signalling requirements in safe areas.

The power supply is critical to the reliability of any system. Cranford's range includes the EN54-4 approved PSU's, which are second to none where maximum performance and functionality are required.

Check out the website for the latest news and comprehensive data on all their products.

For further information, please contact:
Cranford Controls
Tel: 01420 592444
Fax: 01420 592445
Website: www.cranfordcontrols.com

SPP RECEIVE CHINESE APPROVAL

SPP Pumps have added the prestigious approval from China National Fire Equipment to their already extensive range of fire pump approvals.

SPP Fire pumps comply with the demanding requirements of UL and FM approval standards, and are also approved for markets such as Europe, North America, Far East and the Middle East.

Despite SPP's existing approvals Chinese National Fire Equipment demanded to witness rigorous tests on both pumps and assembled packages and a team of people from SPP were dedicated to this project.

Fire Pump approvals are of course essential for the peace of mind of those that build, operate or use buildings. The approval demonstrates that an independent assessment has been made of the Fire Pump Manufacturer's packages and processes and that they conform to industry standards.

In many cases the need for these standards are interpreted as "adequate to get an operating license" whereas the real intention is to ensure that there is no avoidable loss of life or property should a fire start.

Approval of the fire pump package including the pump and its matched control system sits right at the heart of a system that must perform when it is called upon to do so.

Maybe everyone booking a hotel should first, as is often the practice in the United States, check whether the building is fire protected and just as important that the system is approved, tested and maintained system.

Other approvals held by SPP include FM, UL, LPCB, APSAD, CNBOP, ZUS and PSB. These will be found in most types of installation around the world including office buildings, hospitals, airports, manufacturing facilities, warehouses, power stations and many more. Applications include sprinkler, hydrant, deluge and monitor systems and water curtains.

SPP Pumps has been working with consultants, contractors, installers and end-users for more than a century to achieve the most cost effective fire system pumping solutions. It is no wonder that since SPP Pumps was formed in 1875, it has built a reputation for quality and value that has made it unquestionably the leading supplier of Approved Fire Protection Pumping Packages throughout the world.

That is why SPP fire pumps are designed specifically for the very particular needs of fire protection and are approved by most of the major fire protection bodies around the world. You will find SPP fire pumps in many major airports, oil & gas installations, in many of the tallest and most prestigious buildings around the world and in the channel tunnel between the UK and France. In fact, you will find SPP fire pump products wherever people and property need to be protected from the devastation of fire.

By selecting an approved SPP Fire Pump as part of an approved system and maintained in accordance with standards such as NFPA 25, you can sleep easy knowing that you have chosen the best you can get.

SPP know from discussions with China National Fire Equipment that safety considerations are uppermost in their minds and their intention is to expect the highest standards of fire protection when it comes to protection of the lives of inhabitants and visitors and property in the rapidly developing cities in China.

For further information, please contact:
SPP Pumps Limited
Tel: 01189 323123
Fax: 01189 323302
Website: www.spppumps.com

KLAXON'S RANGE NOW CATERS COMPREHENSIVELY FOR THE FIRE MARKET

Klaxon Signals, a world-leading manufacturer of audible and visual signalling technology for fire alarm systems, has made a number of additions to its Fire and Life Safety range, ensuring the company can now cater comprehensively for all major applications and key segments within the fire market.

Among the developments has been the introduction of a completely new sub-range of products known as Sonos, which comprises electronic sounders, sounder beacons, beacons, base sounders and compact sounders. The Sonos range incorporates new sounder and beacon technology, such as the 'twist and click' first fix installation method. All relevant products within the range are compliant with EN54.

In addition to products such as sirens, bells, call points and fire alarms, the company also manufactures security sounders, hazardous area, intrinsically safe and explosion-proof products. All acknowledge DDA guidelines and are compliant with the relevant standards.

Kristian Johnson, Klaxon's Marketing Manager, remarked, "Thanks to continuing developments over the last 18 months, we are now in a position to offer our customers in the fire market a complete collection of complementary products."

For further information, please contact:
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* 67 Fed. Reg. 77927 (Dec. 20, 2002)

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